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Rev. 2.0

CDU-720/722

Intelligent Unibus
SCSI Host Adapter
User's Manual

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CABLE WARRANTY - All CMD provided cables are warranted for ninety (90) days from the time of shipment. Questionable cables should be returned to CMD, freight prepaid, where they will be repaired or replaced by CMD at its option and returned to the Purchaser, freight prepaid.

GENERAL TERMS - The above warranties shall not apply to expendable components such as fuses, bulbs, and the like, nor to connectors, adapters, and other items not a part of the basic product. CMD shall have no obligation to make repairs or to cause replacement required through normal wear and tear or necessitated in whole or in part by catastrophe, fault or negligence of the user, improper or unauthorized use of the product, or use of the product in such a manner for which it was not designed, or by causes external to the product, such as, but not limited to, power failure or air conditioning. CMD's sole obligation hereunder shall be to repair or replace any defective product, and, unless stated, pay return transportation costs within the United States of America for such replacement. Purchaser shall provide labor for removal of the defective product, shipping charges for return to CMD and installation of its replacement. On-site services are not a part of this warranty. Above warranties are subject to change without notice.

RETURNED MATERIAL - Warranty claims must be received by CMD within the applicable warranty period. A replaced product, or part thereof, shall become the property of CMD and shall be returned to CMD at Purchaser's expense. All returned material must be accompanied by a Return Materials Authorization (RMA) number assigned by CMD. For RMA numbers call CMD at (714) 454-0800.

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Return and Repair Policy

WARRANTY PERIOD

The following warranty period is from the date of shipment:

CMD Host Adapter	one year
Cable	90 days
Drive	manufacturer's warranty

RETURN FOR CREDIT

The allowable period of return for credit from the date of shipment is as follows

CMD Host Adapter	less than 30 days
Cable	less than 30 days
Drive	not applicable

RETURN FOR REPAIR

CMD Host Adapter

In-Warranty (Less than 1 year)

- CMD offers a *15 working day turnaround repair service* at the cost of parts only. Defective boards will be repaired and returned to the customer within 15 working days from the date of return to CMD.
- CMD also offers two *in-warranty 24 hour expediting services:*

  24 Hour Turnaround Loaner Service:

  Under this policy, CMD will ship a loaner in 24 hours during regular working days to the customer for a charge of $100.00 per loaner. Upon receiving the loaner, customer must return the defective board to CMD within seven (7) days for repair. CMD will repair the defective board and return the board to the customer. Customer must then return the loaner in seven (7) days after the receipt of the repaired board. Approval for loaner service is based on credit verification.

  24 Hour Turnaround Swap Service:

  In the case that the defective board is within the first six (6) months of the warranty, CMD, at its own option, offers a 24 hour turnaround swap service. CMD will ship the same model of the board to customer within 24 hours during working days in exchange for the defective board. CMD will swap with a new board if board is not functional upon arrival. For all other cases, swap will occur with either a new or refurbished board for a charge of $200.00. CMD does not offer swap services for boards that are purchased more than six months from the date of shipment. Customer is responsible for returning the defective board to CMD within seven (7) days after receipt of the swapped board.
- The remaining warranty period shall apply to the repaired or swapped board.

Out-of-Warranty (more than 1 year)

- CMD offers a *15 working day turnaround repair service* at a rate of $300.00 plus parts and freight for all out-of-warranty host adapter boards. Defective boards will be repaired and returned to customer within 15 working days starting with date of return to CMD.
- CMD also offers an *Out-of-Warranty 24 Hour Turnaround Loaner Service:*

  Under this policy, CMD will ship the same model loaner in the 24 hour time frame of working days to customer for an additional charge of $100.00 plus freight per loaner. The loaner is for use by the customer during the period that the defective board is being repaired. Customer is responsible for returning the defective board to CMD within seven days after the receipt of loaner and returning the loaner in seven (7) days once the defective board is repaired and received. The approval of the loaner service is at CMD's option and based upon customer credit verification.
- CMD will extend warranty for a period of six (6) months on any out of- warranty repaired board.

Cable

In-Warranty (90 days) - free swap.

Out-of-Warranty (90 days) - not applicable.

Drive

In-Warranty (per manufacturer) - manufacturer charge only.

Out-of-Warranty (per manufacturer) - manufacturer charge plus $100 CMD handling.

RETURN FOR UPGRADE/ UPDATE

CMD Host Adapter

In-Warranty (less than 1 year)

- CMD offers a *15 working day turnaround different function upgrade service* for boards that can be upgraded to a higher function; and a *free 15 working day turnaround ECO Field Upgrade* for all its boards. CMD will *upgrade* the hardware of its board to a higher function for a charge of the difference of list prices of the original and upgraded functions. CMD will also update its board to its latest firmware release at no charge to the customer. Boards will be upgraded/updated and returned to the customer within 15 working days from the date of return to CMD.
- CMD also offers *24 hour turnaround loaner service* as stated in "RETURN FOR REPAIR."
- The remaining warranty period shall apply to the updated board. For upgraded boards, CMD will extend warranty for a period of six months.

Out-of-Warranty (More than 1 year)

- CMD offers a *15 working day turnaround different function upgrade service* for boards that can be upgraded to a higher function at a charge of the difference of list prices of two functions. CMD also offers a *free 15 working day turnaround ECO Field Upgrade* for all its boards. Boards will be upgraded/updated and returned to customer within 15 working days from the date of return to CMD.
- CMD also offers *24 hours turnaround Loaner Service* as stated in "RETURN FOR REPAIR."
- There will be no warranty extension for same function firmware update. For different function Hardware upgrade, CMD will extend warranty for a period of six (6) months.

Drive—same as in RETURN FOR REPAIR.

SHIPPING CHARGES

The following shipping charges apply to all REPAIR, SWAP, LOANER, and UPGRADE UNITS.

In-Warranty

- Domestic - freight from CMD to customer is to be paid by CMD; freight from customer to CMD is to be paid by customer.
- International - all fees are to be paid by customer (including custom duty and broker fees).

Out-of Warranty

- Domestic - all fees are to be paid by customer.
- International - all fees are to be paid by customer (including custom duty and broker fees).

GENERAL CONDITIONS

All goods returned to CMD including returns for credit, swap returns, loaner returns, and evaluation returns shall remain in good condition. Any damage or alteration done by the customer will result in a rejection or additional charge to the customer.

Customer must consult CMD Technical Support for authorization of CMD not functional upon arrival boards and swap requests. CMD Sales personnel must be consulted for authorization of returned goods for credit and/or evaluation.

Preface

The CDU-720/722 Rev 2.0 contains the following changes to the previous manual:

- Manual has been reformatted and reorganized.
- On-Board Utility has been improved.

Table of Contents

1 Introduction **1-1**

How to Use this Manual 1-1

Conventions 1-2

2 Features and Specifications **2-1**

Features 2-1

LED Indicators 2-3

Special Features 2-4

Multi-Hosting 2-4

Partitioning 2-4

Tape Monitor Utility 2-4

SCSIformat ON-LINE 2-5

Hardware Shadowing 2-5

SCSI Library Manager 2-6

Generic SCSI Adapter 2-6

Specifications 2-7

3 Installation **3-1**

Determining CSR Address 3-1

Hardware Configuration 3-3

CSR Address Selection 3-3

Disk Auto Boot Selection 3-7

DMA Burst Length and Dwell Time 3-7

Sync/Async Mode Selection 3-8

Single-ended or Differential Mode Selection 3-9

Power ON/OFF Protection 3-9

Tape Fast Search Option 3-10

Tape Monitor Utility and SCSIformat ON-LINE 3-10
Installation 3-11
SCSI Host Adapter ID Selection 3-11
SCSI ID for Target Devices 3-11
CDU-720 Mounting Slot Selection 3-11
Non-Processor Grant Signal 3-12
SCSI Bus Termination 3-14
SCSI Bus Terminator Power 3-14
Installation Procedures 3-15

4 Setup **4-1**
On-Board Utility 4-1
Accessing the Utility Through the PDP System 4-1
Changing LUN Offset 4-5
Formatting the Drive 4-6
Qualifying the Drive 4-6
Manually Replacing Bad Sectors 4-7
Additional Utilities 4-8
Completing Utility Functions 4-15
Unit Numbering For Devices 4-16
Multi-Hosting Configuration 4-19
Partitioning Configuration 4-21
Hardware Shadowing Configuration 4-24
Configuration Instructions 4-24
Detecting Shadowing Errors Using VMS 4-26
VMS Configuration 4-27
ULTRIX Configuration 4-28
CDU-720/T 4-28
CDU-720/M 4-29
CDU-720/TM 4-30

5 SCSI Basics **5-1**
SCSI Glossary 5-1
SCSI Commands 5-2
SCSI Status 5-3
SCSI Messages 5-4
SCSI Single-Ended Signals 5-4
SCSI Differential Signals 5-6

Appendices

A Supported Devices and Operating Systems **A-1**

SCSI Devices A-1

- Magnetic disk drives supported by CDU-720/M and CDU-720/TM A-1
- Erasable Optical disk drives supported by CDU-720/M and CDU-720/TM A-2
- Erasable Optical disk cartridge manufacturers A-2
- CD ROM disk drives supported by CDU-720/M and CDU-720/TM A-2
- WORM drives supported by CDU-720/M and CDU-720/TM A-2
- Tape drives supported by CDU-720/T and CDU-720/TM A-2
- Jukeboxes supported by CDU-720/TMJ A-3

Operating Systems A-3

B Troubleshooting **B-1**

VMS Analyze/Error Utility B-1

Cables B-3

LED Indicators B-3

CMD Technical Support B-4

C Jumper Settings **C-1**

Pin Assignments C-1

CSR Address Selections C-4

D VMS SYSGEN Connect Statement **D-1**

List of Figures

2 Features and Specifications

2-1: CDU-720 LED Indicators 2-3
2-2: CDU-722 LED Indicators 2-3

3 Installation

3-1: Example of SYSGEN Utility 3-3
3-2: Jumper block locations (Hardware Rev. B) 3-6
3-3: Unibus Wire Wrap Side of Backplane 3-12
3-4: CDU-720 cable connection 3-15
3-5: SCSI ID and Cabling 3-16

4 Setup

4-1: PDP Main Menu 4-2
4-2: CDU-720 RS-232 Port 4-4
4-3: SCSI Host Adapter Utility 4-4
4-4: Utility Sub-menu 4-8
4-5: Current configuration, default 4-9
4-6: Configuration change 4-10
4-7: SCSI host adapter ID change 4-12
4-8: Disk and Tape Configuration Change 4-13
4-9: Current configuration 4-21
4-10: Configuration change 4-22
4-11: Partitioning example 4-22
4-12: Current configuration 4-23
4-13: Hardware Shadowing example 4-25
4-14: Current configuration 4-26

5 SCSI Basics

5-1: SCSI device connector 5-4

Appendices

C Jumper Settings

C-1: RS-232 Port connector J4 C-1

D VMS SYSGEN Connect Statement

D-1: SYSGEN Config File D-2
D-2: Unibus Address D-3

List of Tables

2 Features and Specifications

2-1: CDU-720 Models 2-2
2-2: LED Indicators 2-3
2-3: Special Feature Support List 2-4
2-4: Controller Specifications 2-7
2-5: CSR Addesses 2-8

3 Installation

3-1: CDU-720/M CSR Addresses (IC P72009A in U102) 3-4
3-2: CDU-720/T CSR Addresses (IC P72010A in U102) 3-4
3-3: CDU-720/TM Disk CSR Addresses (IC P72008A in U102) 3-5
3-4: CDU-720/TM Tape CSR Addresses (IC P72008A in U102) 3-5
3-5: Disk Auto Boot Selection 3-7
3-6: DMA Burst Length 3-7
3-7: DMA Dwell Time 3-8
3-8: Sync/Async Mode Selection 3-8
3-9: Single-ended or Differential Mode Selection 3-9
3-10: Power ON/OFF Protection 3-9
3-11: Tape Fast Search Option 3-10
3-12: Tape Monitor Utility and SCSIformat ON-LINE Options 3-10
3-13: Device ID Selection 3-11
3-14: Terminator Power Option 3-14

4 Setup

4-1: CSR Addresses Plus 2 Configurations 4-2
4-2: Default for Unit Numbers 4-17
4-3: Host Adapter ID Selection 4-19

5 SCSI Basics

5-1: SCSI Commands (MSCP) 5-2
5-2: SCSI Commands (TMSCP) 5-3
5-3: SCSI Status 5-3
5-4: SCSI Messages 5-4
5-5: Single-Ended Connector Pin Assignments (J1) 5-5
5-6: Differential Connector Pin Assignments (J2) 5-6

Appendices

A Supported Devices and Operating Systems

A-1: Operating Systems Supported by CDU-720/722 A-3

C Jumper Settings

C-1: Pin Assignments for Utility/Front Panel Interface C-2
C-2: Host Adapter ID Selections C-3
C-3: CDU-720 Pin Assignments C-3
C-4: CDU-720/M CSR Addresses (IC P72009A in U102) C-4
C-5: CDU-720/T CSR Addresses (IC P720010A in U102) C-5
C-6: CDU-720/TM Disk CSR Addresses (IC P72008A in U102) C-6
C-7: CDU-720/TM Tape CSR Addresses (IC P72008A in U102) C-6

1

Introduction

This User's Guide explains the basics of your CDU-720™. It includes information on setting up and configuring the system and the CDU-720 for use.

How to Use this Manual

This guide has five chapters and four appendices. Each chapter explains a different aspect of preparing your CDU-720 for use. You may refer to the appendices for further configuration and troubleshooting information. The following descriptions summarize each section.

Chapter 1: Introduction explains the purpose of this guide and details the conventions used.

Chapter 2: CDU-720 Features describes the CDU-720 and details its features, special features, and specifications.

Chapter 3: Installation describes hardware configuration and installation procedures for the CDU-720.

Chapter 4: Setup describes setting up and configuring the CDU-720 and your system for use; this chapter includes Multi-hosting, Partitioning, Shadowing, VMS®, and ULTRIX® set up and configurations.

Chapter 5: SCSI Basics lists a glossary on SCSI terms, SCSI status and command codes for the CDU-720.

Appendix A: Supported Devices and Operating Systems lists the SCSI devices and operating systems compatible with the CDU-720.

Appendix B: Troubleshooting gives some troubleshooting guidelines for the CDU-720.

Appendix C: Jumper Settings lists the jumpers settings, pin assignments, and the CSR addresses for the present revision of the CDU-720.

Appendix D: VMS SYSGEN Connect Statement describes the proper use of the VMS SYSGEN Connect Statement.

Conventions

The following conventions are used in the CDU-720 User's Guide.

Keycaps—Characters in square brackets represent keys on your keyboard. For example, "Press **[ENTER]**" means press the **[ENTER]** key. When two or more keys are joined by a plus sign (+), press those keys at the same time.

Commands—Italics text represents a command that can be used on a system, such *show dev du*.

NOTE Sometimes italics will be used for emphasis; at this time no action is necessary; for example, *do not* remove jumper shunt W13.

Entering Text or Commands on Screen—Text or commands that must be entered on screen will be in italics and bold as ***show dev du***; be sure to enter the text or command and press **[ENTER]**.

2

Features and Specifications

The CDU-720 is an intelligent quad-wide Unibus™ syncronous/asyncronous SCSI host adapter which is fully compatible with the DEC® Mass Storage Control Protocol (MSCP) and the DEC Tape Mass Storage Control Protocol (TMSCP). This chapter details its features, special features, and specifications.

Features

The CDU-720 can be used with the PDP®-11/84, PDP-11/70, PDP-11/44, PDP-11/34, PDP-11/24, VAX® 11/730, VAX 11/750, VAX 11/780, VAX 8250, VAX 8350, VAX 8550, VAX 8600, VAX 8800 and other DEC computers with a Unibus. It supports RSX®, RSTS®, VMS, UNIX®, ULTRIX, DSM-11®, and other operating systems which use the *DU/TU* drivers.

The CDU-720 supports virtual (infinite) data buffer, command queuing, standard SCSI bus arbitration, disconnect and reconnect, and SCSI common command set CCS). Up to seven single-ended SCSI target devices (magnetic disk and tape) can be connected to CDU-720 with SCSI bus data transfer rate up to 4.8-MB/sec in syncronous mode and 3-MB/sec in asyncronous mode.

The CDU-720 supports a variety of SCSI devices including magnetic disk, magnetic tape and optical disk drives. Table 2-1 lists the different models.

Table 2-1 CDU-720 Models

CDU-720/M	supports disk drives only
CDU-720/T	supports tape drives only
CDU-720/TM	supports disk and tape drives simultaneously
CDU-720/TMJ	supports disk and tape drives and jukeboxes simultaneously
CDU-720/TMP	supports disk and tape drives and pass-through mode
CDU-720/TMS	supports disk and tape drives and hardware shadowing
CDU-722	contains the CDU-720 models with differential channel at J2.

NOTE Unless otherwise specified, the CDU-720 will represent all other variations and the CDU-720/TM will represent the CDU-720/TMJ, CDU-720/TMP, and CDU-720/TMS throughout this manual.

The CDU-720/M and CDU-720/TM has an on-board utility for you to configure and format drives, scan bad blocks and replace them automatically. The CDU-720/M and CDU-720/TM contains a selectable bootstrap option which can boot up the system on power up or reset.

The CDU-720/T and CDU-720/TM have an On-Board Utility for you to boot up the system or exercise the tape drives. The Logical Unit Number (LUN) is stored in an onboard non-volatile RAM (NOVRAM). The CDU-720 SCSI host adapter provides you with a 10 pin connector (J4) for the On-Board RS-232 Utility. See Appendix C for pin assignments.

The CDU-722 consists of CDU-720 and on-board differential SCSI drivers and receivers. You can select either single-ended mode, J1 or differential mode, J2.

LED Indicators

The CDU-720 has three LED modules and the CDU-722 has four LED modules in the front of the board. (see Figure 2-1 for CDU-720 and Figure 2-2 for CDU-722).

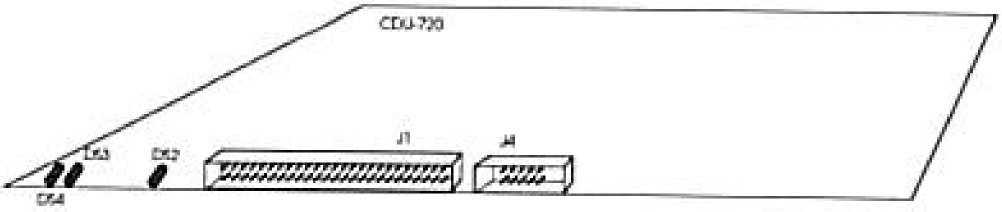


Figure 2-1: CDU-720 LED Indicators

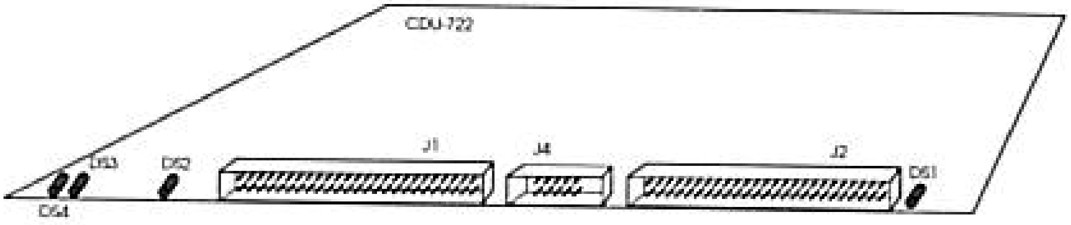


Figure 2-2: CDU-722 LED Indicators

Table 2-2 lists the LED indicators for CDU-720 and CDU-722.

Table 2-2 LED Indicators

LED	Color	Location	Indication
DS1	Green	right	Differential SCSI mode selected.
DS2	Green	third left	Single-ended SCSI mode selected.
DS3	Red	second left	Error condition occurred.
DS4	Green	first left	Power-up OK and activity indicator. Upon power up, this LED is turned on when the CDU-720 succeeds in the self-diagnostic testing. During normal controller operation, this LED is blinking to show controller activity.

Special Features

The CMD CDU-720 controller provides special features, such as multi-hosting, partitioning, hardware shadowing, Tape Monitor Utility(TMU), on-line formatting (FMT), SCSI Library Manager (SLM), and Generic SCSI Adapter (GSA). Table 2-3 lists the special features.

Table 2-3 Special Feature Support List

Model	Multi-hosting	Partitioning	TMU	FMT	Shadowing	SLM	GSA
/T	Yes	No	Yes	No	No	No	No
/M	Yes	Yes	No	Yes	No	No	No
/TM	Yes	Yes	Yes	Yes	No	No	No
/TMS	Yes	No	Yes	Yes	Yes	No	No
/TMJ	Yes	Yes	Yes	Yes	No	Yes	No
/TMP	Yes	No	Yes	No	No	No	Yes

Multi-Hosting

CMD's multi-host solution can support disk, tape, and optical devices including jukeboxes. It gives you the ability to completely share an array of disks and tapes between multiple VAX systems running VAX cluster software. Multi-hosting configuration instructions are given in Chapter 4. Refer to Appendix A for supported disk and tape devices.

Partitioning

CDU-720 gives you the ability to partition devices. Partitioning makes one physical device appear as two or four equal sized logical devices. Partitioning is used for operating systems that do not support large devices such as RT-11. Partitioning configuration instructions are given in Chapter 4.

Tape Monitor Utility

The Tape Monitor Utility™ (TMU) is an application software that works exclusively with CMD SCSI host adapters as an **optional** feature for VAX/VMS systems.

This Tape Monitor Utility™ displays the tape drive vendor identification, drive firmware revision, the remaining tape capacity, percentage/number of rewrites during writes or percentage/number of ECC retrys during reads (see manufacturer's documentation for returns whether percentages or numbers), and current tape operations such as read, write, write file mark, space, rewind, etc. You can install multiple CDU-720's and tape drives in one site and observe all tape activity from any VAX terminal locally or across the network without any additional add-in hardware. You can also open a file to log all the information during unattended backup.

To install the Tape Monitor Utility, follow the instructions given in the accompanying CMD Tape Monitor Utility User's Manual part number MAN-000TMU-000 and install jumper shunt as given in Chapter 3, subsection "Tape Monitor Utility and SCSIformat ON-LINE."

SCSIformat ON-LINE

The SCSIformat ON-LINE (FMT) is an application software that works exclusively with CMD SCSI host adapters as an optional feature for VAX/VMS systems. This SCSIformat ON-LINE allows you to format the disk drives without interfering with the other devices on the SCSI bus. To install SCSIformat ON-LINE follow the instructions given in the accompanying SCSIformat ON-LINE User's Manual and install jumper shunt as given in Chapter 3, subsection "Tape Monitor Utility and SCSIformat ON-LINE."

Hardware Shadowing

The Super Shadow CDU-720/TMS is a hardware variation of the CDU-720/TM. Installation and setup of CMD shadowing host adapters are simplified with the CMD On-Board Utilities. This easy to use menu-driven utility allows you to quickly configure virtually any combination of disk shadow sets. See Chapter 4 for Hardware Shadowing Configuration.

The hardware disk shadowing on DEC computers enables simultaneous writing of data to two shadow set members. This provides an exact real-time duplicate data set that can be later retrieved by the user if data on primary disk becomes unaccessible.

The access performance benefits are derived from the ability to read data from a particular disk in the shadow set that responds faster. By adapting specific host adapter resident firmware algorithms, CDU-720/TMS provides incredible performance benefits with disk access time reduced 100% or more during reads.

The hardware-based shadowing technique also results in far less VMS overhead and much higher data availability than software solutions.

You can now configure complete SCSI drive failure tolerant subsystems built around Super Shadow host adapters. When used in conjunction with other CMD exclusive features like Multi-Host capability, subsystem data availability can be increased substantially.

SCSI Library Manager

The SCSI Library Manager (SLM) is an optional application software that works exclusively with CMD SCSI host adapter CDU-720/TMJ for VAX/VMS systems.

This SCSI Library Manager was designed to work with multiple jukeboxes as well as a single jukebox with from one to five erasable optical or WORM drives installed. With just a few menu-driven keystrokes SLM controls all basic operations like inserting, removing and flipping erasable or WORM cartridges from the drive unit.

In addition to giving you complete control of jukebox functions, SLM also has a build-in callable user interface allowing you to customize SLM to your needs. This is especially useful for applications to support file management.

Generic SCSI Adapter

The Generic SCSI Adapter (GSA) is an application software that works exclusively with CMD SCSI host adapter CDU-720/TMP for VAX/VMS systems.

This Generic SCSI Adapter allows you to send the generic SCSI commands to the disk or tape drives through the standard DEC *DU* driver. The GSA itself is a simple and straightforward callable user interface providing an easier way for you to communicate with the device directly.

Specifications

Table 2-4 lists the controller specifications for the CDU-720.

Table 2-4 Controller Specifications

Emulation	MSCP (*DU* driver) / TMSCP (*TU* driver)
Bus Interface	Standard Unibus
Interrupt Vector	Software programmable
Command Queuing	Commands with optimized seek
Data Buffer Capacity	Virtual data buffer (infinite size)
Bootstrap	Auto bootstrap or utility bootstrap
Defect Management	Dynamic defect management
Software Supported	All standard DEC operating systems
Multiple-Hosting	Support multiple-hosting for disks, optical drives and tapes.
Formatting	On board format and bad block replacement (ISO standard for optical erasable disk format)
Partitioning	2 or 4 equally divided partitions for disk drives
Shadowing	Any two disk drives of equal size on the bus can form a shadow set (for /TMS version only)
Optional Software	Tape Monitor Utility (TMU) SCSIformat ON-LINE (FMT) SCSI Library Manager (SLM for /TMJ only) Generic SCSI Adapter (GSA for /TMP only)
LED Indicators	Self test, error conditions
Peripheral Interface	Small Computer System Interface (SCSI)
SCSI Transfer Rate:	4.8-MB/sec in Synchronous mode 3.0-MB/sec in Asynchronous mode
SCSI Bus Parity	Odd parity
Devices Supported	Up to 7 SCSI devices CDU-720/M disk drives CDU-720/T tape drives CDU-720/TM disk and tape drives (default = 4 disks/3 tapes)
System Performance	Support disconnect/reconnect capability and multiple-host configuration
SCSI Driver/Receiver	CDU-720—Single-ended CDU-722—Single-ended or differential
SCSI Cable Length	Single-ended, up to 20-feet (6-meters) Differential, up to 80-feet (25-meters)
Operating Temperature	5° C to 50° C
Relative Humidity	10% to 90% , Non-condensing
Power Requirement	5V DC, 2.8 A

Table 2-5 lists the CSR addresses for the CDU-720. For complete CSR addresses, see Chapter 3 and Appendix C.

Table 2-5 CSR Addesses

CDU-720/M (Disk only) IC P72009A (U102)	772150, 760334, 760354, 760374, 760340, 760344, 760350, 760360, and up to 29 CSR addresses
CDU-720/T (Tape only) IC P72010A (U102)	774500, 760404, 760444, 760504, 760544, 760410, 760450, 760454, and up to 31 CSR addresses
CDU-720/TM IC P72008A (U102)	772150, 760334, 760354, 760374, 760340, 760344, 760350, disable disk 774500, 760404, 760444, 760504, 760544, 760410, 760450, disable tape

3

Installation

This chapter instructs you on configuring the CDU-720 and installing it into the system. Follow the instructions in this chapter in the order presented.

Determining CSR Address

Before you install the CDU-720 SCSI host adapter under the VMS operating system you must determine the Control and Status Register (CSR) address for the CDU-720.

For the CDU-720/M or CDU-720/T, only one CSR address is required. For the CDU-720/TM, two CSR addresses are required. The following procedure shows one method of determining the new CSR address for the CDU-720.

WARNING **Do not install the new CDU-720 in the system at this time.**

1 Boot the VMS system and log into the system manager account.

2 At the DCL $ prompt, enter *mc sysgen*.

3 At the prompt *sysgen*, enter ***show/config***. The Sysgen Utility will display all the device controllers installed in the system and their corresponding CSR addresses and vectors. Make a note of this list.

4 At the prompt *sysgen*, enter ***config***. This will give you the *device* prompt.

5 At the prompt *device*, enter the following for your CDU-720 model.

For CDU-720/M	enter ***UDA, X***
For CDU-720/T	enter ***TU81, Y***
For CDU-720/TM	enter ***UDA, X*** and ***TU81, Y***

where
X is the number of installed *UDA* type controllers plus 1 (for the new one being added).
Y is the number of installed *TU81* type controllers plus 1 (for the new one being added).

NOTE Enter all devices on the Q-bus, not just the new device being added at present.

6 At the prompt *device*, enter **[CTRL] + Z**. The Sysgen Utility will display the CSR addresses for all the controllers. Make sure that no other vectors or CSR addresses have changed; if they have, make the appropriate changes to the devices.

The VMS mnemonic for MSCP disk controllers are PUA, PUB, PUC, etc. The VMS mnemonic for TMSCP tape controllers are PTA, PTB, PTC, etc. For other mnemonics, refer to VMS system manager's guide.

Use the corresponding CSR address to configure the CSR jumper settings of the CDU-720 (see "CSR Address Selection").

7 At the prompt *SYSGEN*, enter **[CTRL] + Z** to exit the SYSGEN Utility.

NOTE VMS will automatically program the CDU-720's interrupt vector register to match the vector assigned by the system. The vectors of DHV11 or other controllers might change when the CDU-720 is added to the system; see manufacturer's documentation to configure vectors and device CSR addresses if hardware selectable.

The example in Figure 3-1 explains the Sysgen Utility procedure for installing the CDU-720/TM in VMS system. In this example, the CSR addresses of PUB and PTB should be used to configure the CSR jumpers of the CDU-720/TM. In the example, notice the CSR and vector changes for the DHV11.

```
$ MC SYSGEN
SYSGEN> SHOW/CONFIG

System CSR and VECTOR on 2-JUN-1989 04:10:43.30

Name: PUA Units:1  Nexus:0 (UBA)  CSR:772150  Vector:774  Vector2:0
Name: PTA Units:1  Nexus:0 (UBA)  CSR:774500  Vector:260  Vector2:0
Name: TXA Units:16 Nexus:0 (UBA)  CSR:760440  Vector:300  Vector2:304

SYSGEN> CONFIG
DEVICE> UDA,2
DEVICE> TU81,2
DEVICE> DHV11,1
DEVICE> ^Z

Device: UDA     Name: PUA   CSR: 772150   Vector:154    Support: Y
Device: TU81    Name: PTA   CSR: 774500   Vector:260    Support: Y
Device: UDA     Name: PUB   CSR: 760334*  Vector:300*   Support: Y
Device: TU81    Name: PTB   CSR: 760404*  Vector:304*   Support: Y
Device: DHV11   Name: TXA   CSR: 760500   Vector:310*   Support: Y

SYSGEN>  ^Z
$
```

Figure 3-1: Example of SYSGEN Utility

Hardware Configuration

Normally, you do not need to change the factory jumper settings of the CDU-720 except for the CSR address jumper SW1 as shown in the following subsections.

CSR Address Selection

The CDU-720 jumpers allow you to select different CSR addresses. If you require other CSR addresses than listed, consult CMD Technology.

The CDU-720/M (with the IC P72009A in U102) supports 29 disk CSR addresses. Only eight disk CSR jumper settings are shown in Table 3-1. Refer to Appendix C for the other CSR jumper settings.

WARNING **Be sure to wear anti-static wrist straps or equivalent to protect the CDU-720 from electro-static damage.**

Table 3-1 **CDU-720/M CSR Addresses (IC P72009A in U102)**

Address	PDP-11	W11	W12	W13	W14	W15
1	17772150 (F)	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
2	17760334	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
3	17760354	1-2 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
4	17760374	1-2 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN
5	17760340	2-3 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
6	17760344	2-3 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
7	17760350	2-3 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
8	17760360	2-3 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN

Table 3-2 lists the tape CSR addresses supported by the CDU-720/T with the IC P720010A in U102; IC P72010A in U102 supports up to 31 CSR addresses and are shown in Appendix C.

Table 3-2 **CDU-720/T CSR Addresses (IC P72010A in U102)**

Address	PDP-11	W12	W13	W14	W15	W16
1	17774500 (F)	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
2	17760404	1-2 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN
3	17760444	1-2 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN
4	17760504	1-2 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN
5	17760544	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
6	17760410	1-2 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN
7	17760450	1-2 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN
8	17760454	1-2 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN

Table 3-3 lists eight disk and Table 3-4 eight tape CSR addresses supported by the CDU-720/TM with the IC P72008A in U102.

Table 3-3 CDU-720/TM Disk CSR Addresses (IC P72008A In U102)

Address	PDP-11	W11	W12	W13
1	17772150 (F)	1-2 IN	1-2 IN	1-2 IN
2	17760334	1-2 IN	1-2 IN	2-3 IN
3	17760354	1-2 IN	2-3 IN	1-2 IN
4	17760374	1-2 IN	2-3 IN	2-3 IN
5	17760340	2-3 IN	1-2 IN	1-2 IN
6	17760344	2-3 IN	1-2 IN	2-3 IN
7	17760350	2-3 IN	2-3 IN	1-2 IN
8	Disable Disk	2-3 IN	2-3 IN	2-3 IN

Table 3-4 CDU-720/TM Tape CSR Addresses (IC P72008A In U102)

Address	PDP-11	W14	W15	W16
1	17774500 (F)	1-2 IN	1-2 IN	1-2 IN
2	17760404	1-2 IN	1-2 IN	2-3 IN
3	17760444	1-2 IN	2-3 IN	1-2 IN
4	17760504	1-2 IN	2-3 IN	2-3 IN
5	17760544	2-3 IN	1-2 IN	1-2 IN
6	17760410	2-3 IN	1-2 IN	2-3 IN
7	17760450	2-3 IN	2-3 IN	1-2 IN
8	Disable Tape	2-3 IN	2-3 IN	2-3 IN

Please refer to Figure 3-2 for jumper locations.

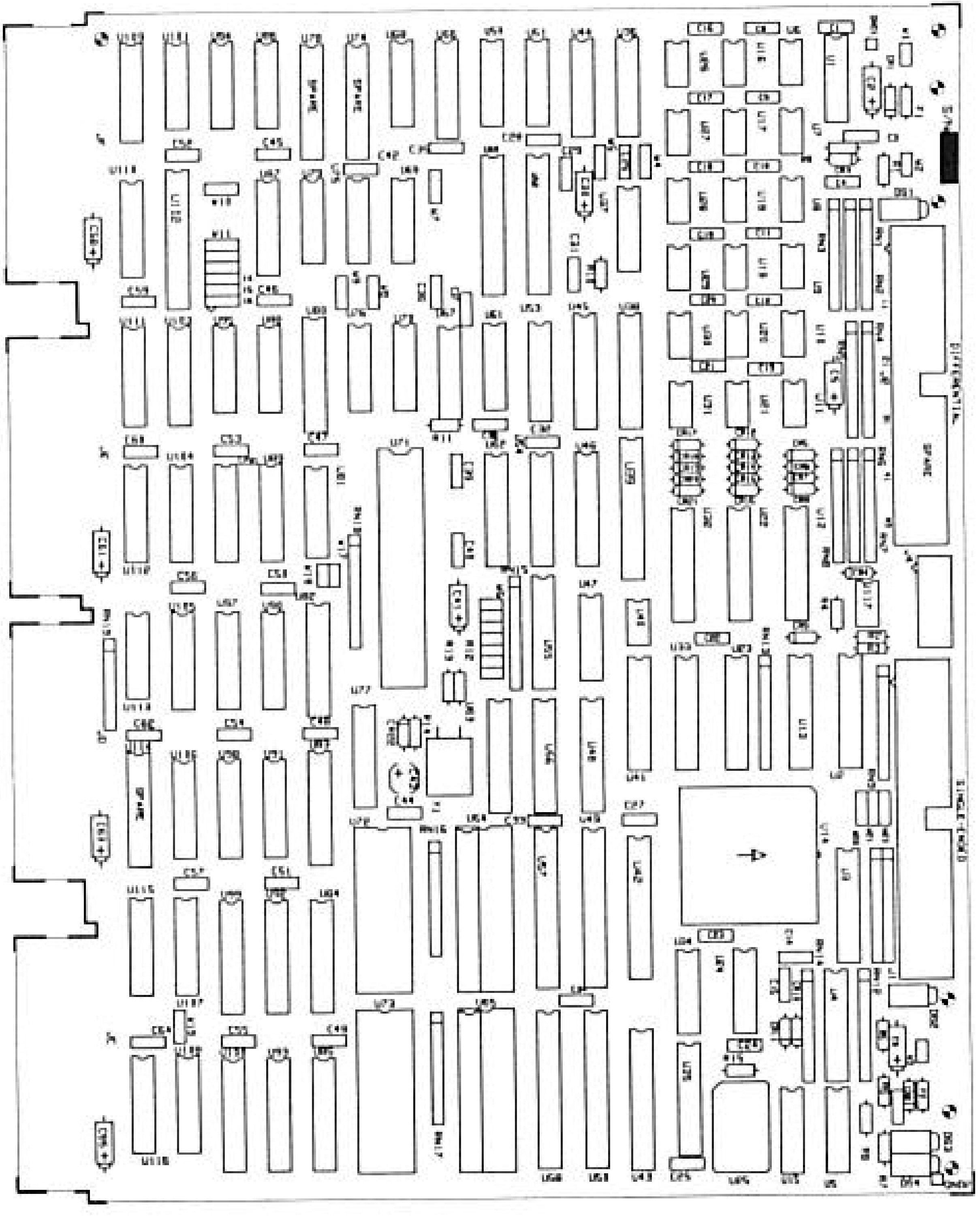


Figure 3-2: Jumper block locations (Rev. B)

Disk Auto Boot Selection

Disk Auto Boot Selection is used for the PDP-11 disk processors only. The CDU-720/M or CDU-720/TM may be set to provide an auto-bootstrap at 773000 or 771000 on power up or whenever the "boot" switch is pressed. The CDU-720/M will auto-boot only if the controller CSR is set to the standard address, 772150. Disk drive 0 will be bootstrapped. Table 3-5 lists Disk Auto Boot Selections.

Table 3-5 Disk Auto Boot Selection

W5	2-3 IN	Auto-Bootstrap enabled
W5	1-2 IN	Auto-Bootstrap disabled (F)
W10	1-2 IN	Auto-Bootstrap address = 773000
W10	2-3 IN	Auto-Bootstrap address = 771000 (F)

Note that (F) means factory setting.

If there is an existing bootstrap ROM at 773000, you must set the CDU-720 auto-bootstrap address at 771000. To boot the CDU-720, type 771000G from ODT instead of the normal 773000G.

DMA Burst Length and Dwell Time

The Burst Length determines how many words the CDU-720 transfers by DMA during each NPR. The Dwell time is the time the CDU-720 waits before it requests for another NPR. Table 3-6 lists the selections.

Table 3-6 DMA Burst Length

W8	W9	Words per NPR
2-3 IN	2-3 IN	1 Word per NPR (F for /T & /TM)
1-2 IN	2-3 IN	2 Words per NPR
1-2 IN	1-2 IN	4 Words per NPR (F for /M)

Note that (F) means factory setting.

You can select the period of the Dwell Time by changing the jumper shunts listed in Table 3-7.

Table 3-7 DMA Dwell Time

W7	1-2 IN	4 micro second DMA dwell time (F for /M)
W7	2-3 IN	2 micro second DMA dwell time (F for /T & /TM)

Note that (F) means factory setting.

NOTE If the CDU-720 is installed in a VAX BI Unibus (VAX 8350, 8750, etc.), the setting must be one word per NPR and two micro second dwell time. Data compare errors will occur on the VAX BI Unibus if the throughput is set to more than the BI Unibus adapter can handle. On the PDP-11 and Non-BI VAX (VAX-730, 750, 780, and others) Unibus you may set the controller to four words per NPR and four micro second Dwell time.

Sync/Async Mode Selection

The CDU-720 comes standard in synchronous (sync.) mode. Most SCSI devices support to sync. mode. In sync. mode, CDU-720 will automatically communicate with each SCSI device connected to find out whether the sync. mode is supported by the device.

In async. mode, CDU-720 will communicate with the SCSI device asynchronously even if the SCSI device supports sync. mode. Most of the sync. SCSI devices also support async. mode.

You can change the CDU-720 to async. mode using the jumpers listed in Table 3-8; these jumpers control the overall sync./async. mode selection and will override the On-Board Utility sync. mode set-up.

Table 3-8 Sync/Async Mode Selection

W6-6	IN	Tape sync. mode disabled
W6-6	OUT	Tape sync. mode enabled (F)
W6-7	IN	Disk sync. mode disabled
W6-7	OUT	Disk sync. mode enabled (F)

Note that (F) means factory setting.

Single-ended or Differential Mode Selection

The CDU-720 SCSI port comes with both single-ended and differential SCSI drivers and receivers. A jumper W2 is available for users to select the channel. When a jumper shunt is installed in W2 pin 1-3 location, single-ended SCSI drivers and receivers are enabled and DS2 green LED will be ON. Note that single-ended SCSI devices should be connected to the J2 connector. When a jumper shunt is installed in W20, W21, W22 pin 2-3 location, the differential drivers and receivers are enabled and DS1 green LED will be ON. Note that differential SCSI devices should be connected to the J2 connector. The factory setting is W20, W21, W22 1-2 IN (single-ended enabled).

Table 3-9 Single-ended or Differential Mode Selection

W20, W21, W22	1-2 IN	Single-ended channel enabled (F)
W20, W21, W22	2-3 IN	Differential channel enabled

Note that (F) means factory setting.

Power ON/OFF Protection

Circuits are added (from hardware revision B and up) to protect the SCSI bus from glitching when you turn ON or OFF the power to the CDU-720. To enable the protection circuit of the single-ended SCSI port, install jumper shunt W20, W21 pin 2-3. To enable the protection circuit of the differential SCSI port, install jumper shunt W20, W21 pin 1-2.

Normally, the power ON/OFF protection selection is jumpered to match the SCSI mode selected.

Table 3-10 Power ON/OFF Protection

W20, W21	1-2 IN	Differential SCSI Circuit Power Protection enabled
W20, W21	2-3 IN	Single-ended SCSI Circuit Power Protection enabled (F)

Note that (F) means factory setting.

Tape Fast Search Option

This option is supported only by the CDU-720/T or CDU-720/TM. When set to the Tape Fast Search mode, the CDU-720/T or CDU-720/TM will enable high speed forward and reverse filemark search. VMS may use this mode if you do not attempt a standalone boot or run other programs that require the controller to keep track of the number of data records between filemarks. **In VMS standalone boot application, this option needs to be disabled.** For the ISM-11 operating system, this jumper shunt has to be installed. CMD recommends you use this option for ULTRIX and UNIX systems. Table 3-11 lists the jumper settings.

Table 3-11 Tape Fast Search Option

W6-4	IN	Enable tape fast search option
W6-4	OUT	Normal operation (F)

Note that (F) means factory setting.

Tape Monitor Utility and SCSIformat ON-LINE

As explained in Chapter 2, the Tape Monitor Utility will allow you to monitor tape devices on the SCSI bus; and the SCSIformat ON-LINE will allow you to format SCSI devices through the CDU-720 and the software provided. To enable these features you must install the Tape Monitor Utility and SCSIformat ON-LINE as explained in their respective User's Manuals and install jumper shunt in W10-7 as shown in Table 3-12. For any operating system other than VMS, this jumper must not be installed.

WARNING **Do not insert this jumper shunt if the TMU or FMT application software is not installed. The factory setting of W6-5 is in OUT position (disabled).**

Table 3-12 Tape Monitor Utility and SCSIformat ON-LINE Options

W6-5	IN	Tape Monitor Utility enabled (/T, /TM) Disk SCSIformat ON-LINE enabled (/M, /TM)
W6-5	OUT	Tape Monitor Utility disabled (F) Disk SCSIformat ON-LINE disabled (F)

Note that (F) means factory setting.

Installation

This section gives you instructions for installing the CDU-720 into a system. Remember to turn off the power of the system and SCSI devices while installing the SCSI cable and terminator.

SCSI Host Adapter ID Selection

Each device on the SCSI bus requires a unique SCSI identification address (0-7). SCSI ID 7 has the highest priority on the bus and SCSI ID 0 has the lowest priority. The CDU-720 SCSI Host Adapter is factory configured to SCSI ID 7. Do not change this setting unless you are setting a multi-hosting configuration (see Multi-hosting in Chapter 4).

SCSI ID for Target Devices

Each SCSI device (initiator or target) on the SCSI bus requires a unique SCSI ID number. Since the CDU-720 has been set to SCSI ID 7 (initiator), target devices must be configured from SCSI ID 0 to 6. For the CDU-720/TM, if you have more than four disks drives or three tapes drives you *must* use the On-Board Utility to change the configuration; otherwise, *do not* change the configuration. See Table 3-13 for SCSI Device ID Selections.

Table 3-13 Device ID Selection

Model	Device Support	Target SCSI ID
CDU-720/M	up to 7 disk drives	SCSI ID = 0 to 6
CDU-720/T	up to 7 tape drives	SCSI ID = 0 to 6
CDU-720/TM	up to 7 disk/tape drives combined 4 disk drives & 3 tape drives (F)	SCSI ID = 0 to 3 disks (F) SCSI ID = 4 to 6 tapes (F)

Note that (F) means factory setting.

CDU-720 Mounting Slot Selection

The CDU-720 can be installed in any priority on the standard PDP-11 Unibus SPC backplane. The CDU-720 is a DMA device and requires the Non-processor Grant (NPG) jumper on the SPC card slot in which the controller is being installed be removed. It is recommended that the CDU-720 be placed in front of other devices on the Unibus except when there is an Ethernet controller which should go first. The CDU-720 should be inserted into C, D, E, F sockets of a Unibus slot.

Non-Processor Grant Signal

The Non-Processor Grant Signal (NPG) signal jumper is located at pins CA1 to CB1 on the Unibus backplane. Figure 3-3 is a DD11-DK nine-slot backplane seen from the rear. To locate the NPG jumper follow these instructions:

1. From the rear of the backplane locate the card slot in which the board is to be installed. Each card slot is four pins wide.
2. Locate the C socket and then locate the pins CA1 and CB1. Remove the jumper wire between the two pins as shown in Figure 3-3.

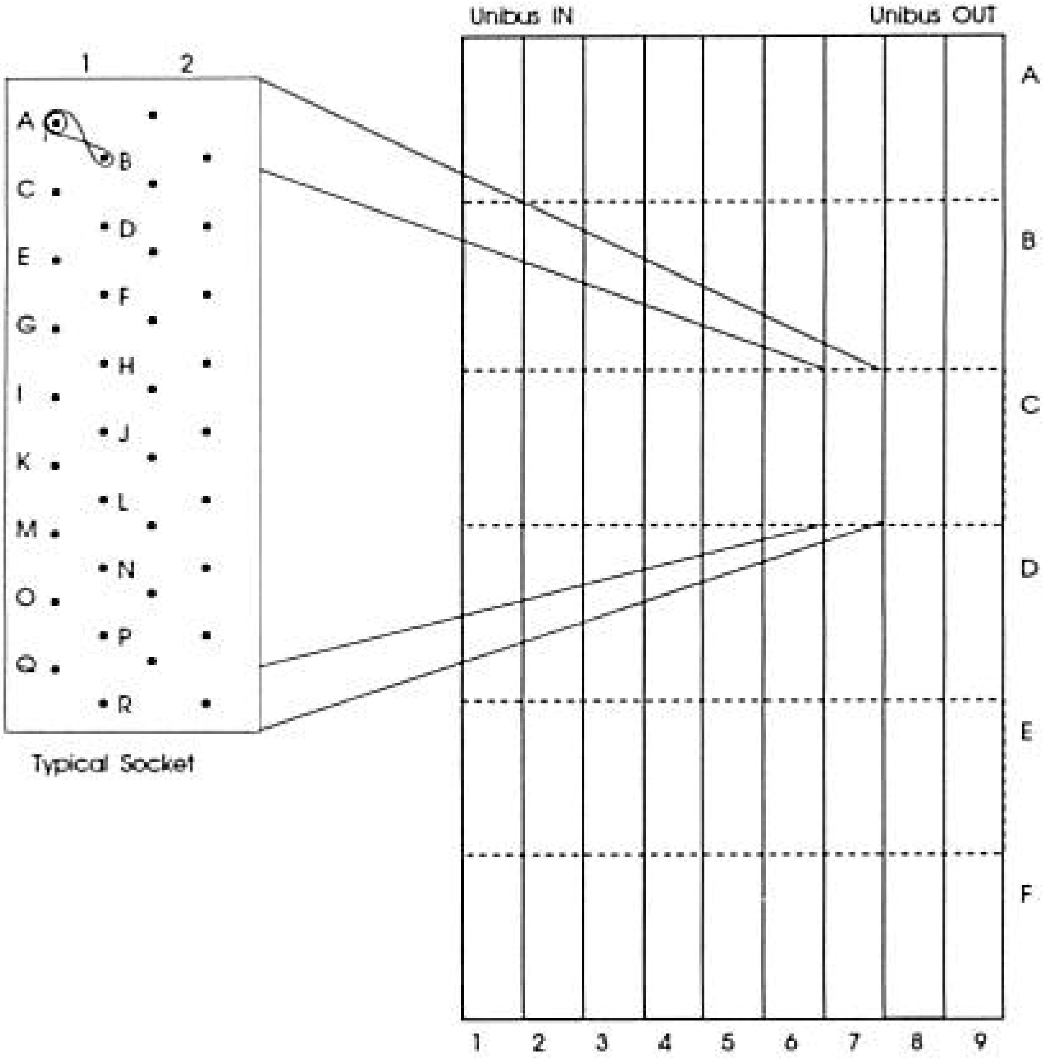


Figure 3-3: Unibus Wire Wrap Side of Backplane

SCSI Bus Cabling

Single-ended—The CDU-720 provides a 50-pin connector (J1) to interface with external singel-ended SCSI devices.

- When the CDU-720 and the SCSI devices are installed in the same cabinet which meets EMI/RFI shielding requirements, a 25-signal **twisted-pair cable** must be used for connecting the CDU-720 (J1) and the SCSI devices.
- When the CDU-720 and the SCSI devices are installed in separated cabinets, the shielded SCSI cable should be used to meet FCC requirements.
- A minimum conductor size of 28-AWG must be used to minimize noise effects and ensure proper distribution of optional terminator power.
- The maximum cable length is 6.0-meters or 20-feet in single-ended channel.

Differential—The CDU-720 also provides a 50-pin connector (J2) to interface with external differential SCSI devices.

- When the CDU-720 and the external SCSI devices are installed in the same cabinet which meets EMI/RFI shielding requirements, a 25-signal **twisted-pair cable** must be used for connecting the CDU-720 (J2) and the external SCSI devices.
- When the CDU-720 and the external SCSI devices are installed in separated cabinets, the shielded SCSI cable should be used to meet FCC requirements. A 25-signal **twisted-pair cable** must be used to eliminate the crosstalk between adjacent signals causing spurious pulses on differential signals which will occur even at slow data transfer rates and short cable distances. Each pair should be connected to the same signal, one wire to the positive and the other wire to the negative signal.
- Cables should consist of conductors of 26-AWG or 28-AWG.
- The maximum cable length is 25-meters or 80-feet in differential channel.

SCSI Bus Termination

The CDU-720 can be installed in any position of the SCSI cable. If the CDU-720 is installed in either end of SCSI cable, on-board terminators should remain on board. If the CDU-720 is in the middle of the SCSI bus, on-board terminators should be removed.

Single-ended—The SCSI bus signals should be terminated with 220-ohms to +5-volts and 330-ohms to ground at each end of the cable. The CDU-720 provides on-board removable terminators (RN9, RN10, and RN14), which are next to the SCSI connector J1.

Differential—Every differential signal pair should be terminated with 330-ohms resistor between the negative signal and +5-volts, 330-ohms between the positive signal and ground, and 150-ohms between the positive and the negative signal at each end of the SCSI cable. The CDU-722 provides on-board removable terminators (RN1, RN2, RN3, RN4, RN5, RN6, RN7, and RN8) which are next to the connector J2.

SCSI Bus Terminator Power

Any SCSI terminator (on-drive or external) needs to be powered by at least one SCSI device, otherwise the SCSI signals will be pulled down. Typically an initiator (SCSI host adapter) provides the power to the on-board terminator, external SCSI terminator and on-drive terminator when the drive is powered off. Anytime an external SCSI terminator (instead of the on-drive SCSI terminator) is used, the SCSI terminator power option of the CDU-720 has to be enabled, i.e. install jumper shunt at W1 or W3.

A minimum conductor size of 28-AWG shall be employed to minimize noise effects and ensure proper distribution of optional terminator power. The CDU-720 and CDU-722 supplies terminator power to the TERMPWR pin (J1, pin 26; J2, pin 25 and 26), through a fuse, a diode and jumper block W2 for differential and W3 for single-ended (see Table 3-14).

Table 3-14 Terminator Power Option

W2	IN	Differential SCSI terminator power enabled (F)
W2	OUT	Differential SCSI terminator power disabled
W3	IN	Single-ended SCSI terminator power enabled (F)
W3	OUT	Single-ended SCSI terminator power disabled

Note that (F) means factory setting.

Installation Procedures

1 Determine the CSR address for the CDU-720 as explained in "Determining CSR Address."

WARNING **Be sure to wear anti-static wrist straps or equivalent to protect the CDU-720 from electro-static damage.**

2 Configure the hardware as explained in "Hardware Configuration."

3 Set the CDU-720 and Device SCSI ID's as explained in "SCSI Host Adapter ID Selection" and "SCSI Device ID Selection."

4 Choose a proper slot to place the CDU-720; and install it into that slot (see "CDU-720 Mounting Slot Selection").

5 Connect SCSI cable to J1 for single-ended or J2 for differential of the CDU-720 using cable specifications given in "SCSI Bus Cabling," see Figure 3-4.

WARNING **In order to prevent accidental grounding or misconnection of terminator power, make sure that the pin 1 mark of SCSI cable matches with the pin 1 mark of SCSI device's connector before turning on the power.**

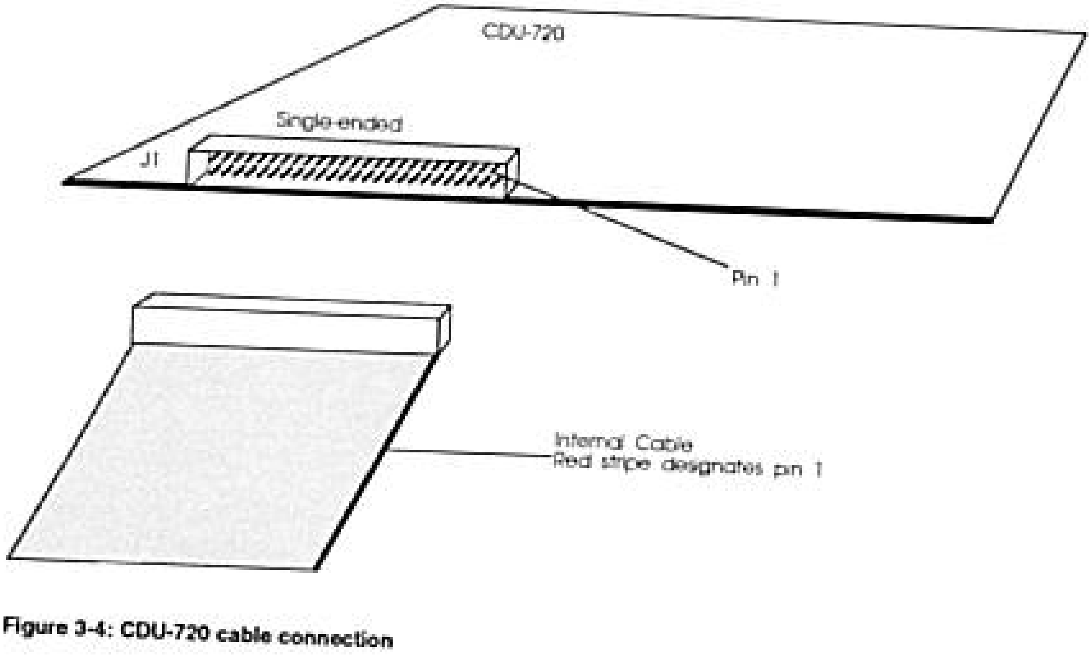


Figure 3-4: CDU-720 cable connection

6 Continue SCSI cabling to connect up to seven SCSI devices to the CDU-720. See the example in Figure 3-5.

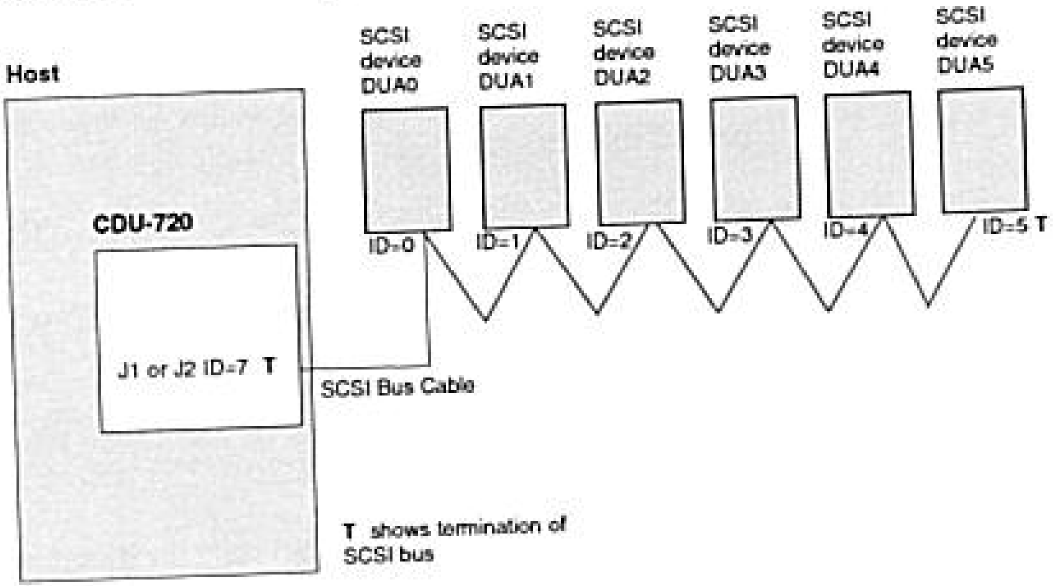


Figure 3-5: SCSI ID and Cabling

7 Terminate the SCSI bus at each *physical* end; see "SCSI Bus Termination."

If TERMPWR is needed for the bus, place jumper shunt on W1 or W3 as explained in "SCSI Bus Terminator Power" (see the example in Figure 3-5).

8 Power up the system and execute On-Board Utility to scan for the SCSI devices and assure that all devices are seen and functioning properly (see Chapter 4 for On-Board Utility).

9 Boot the system and test with the operating system.

4

Setup

This chapter will assist you in setting up the CDU-720 and your system for use.

On-Board Utility

The CDU-720 SCSI host adapter comes with a general purpose On-Board Utility for all systems. The On-Board Utility can test the system slot, SCSI cable, and SCSI devices connected to the CDU-720. Accessing the Utility can be done through PDP system or the RS-232 Port. Be sure to complete utility functions, explained at the end of this chapter.

Accessing the Utility Through the PDP System

The On-Board Utility Program can be accessed by means of an ODT command for PDP systems. One example is shown with the SCSI host adapter set to the first disk CSR address.

NOTE Accessing the Utility from the PDP system insures that the host recognizes the CDU-710.

PDP-11/24 Systems

Follow these instructions for using the Disk Utility with PDP-11/24 Systems.

1. Halt the processor.
2. Hit the Boot Switch.

3 Enter ***CSR address plus 2*** (in Octal), ***a slash***, and ***123456***. See Table 4-1 for CSR Address Plus 2 configurations. Other CSR addresses can be found in Chapter 3 or Appendix C (see the example below).

Table 4-1 CSR Addresses Plus 2 Configurations

DISK:		TAPE:	
CSR Address	**CSR Addr. Plus 2**	**CSR Address**	**CSR Addr. Plus 2**
17772150	17772152	17774500	17774502
17760334	17760336	17760404	17760406
17760354	17760356	17760444	17760446
17760374	17760376	17760504	17760506
17760340	17760342	17760544	17760546
17760344	17760346	17760410	17760412
17760350	17760352	17760450	17760452
17760360	17760362	17760454	17760456

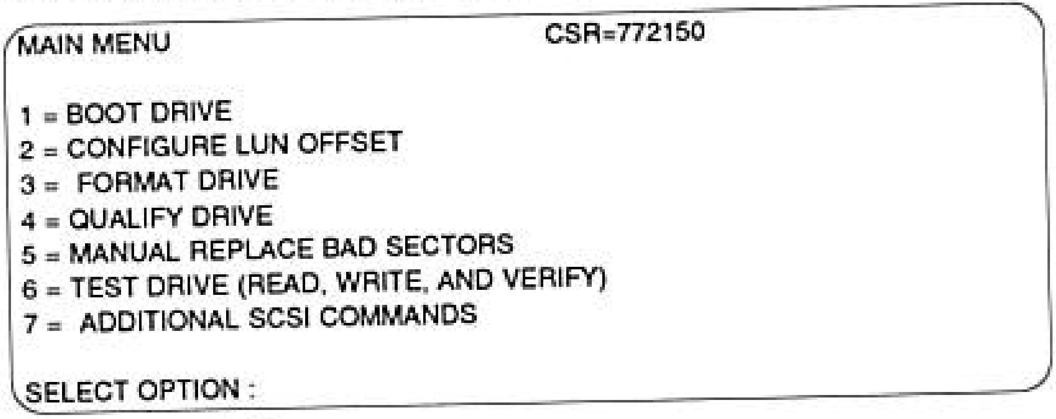
4 Enter ***CSR address plus 2*** (in Octal), ***a slash***, and ***100*** to load the utility to the system memory.

5 Enter ***5000G***.

EXAMPLE For steps **3** to **5** with CSR 17772150, enter the following:

```
772152/005400   123456    [ENTER]
772152/   100    [ENTER]
5000G    [ENTER]
```

The Utility program will begin executing as shown in Figure 4-1.



```
MAIN MENU                                    CSR=772150

1 = BOOT DRIVE
2 = CONFIGURE LUN OFFSET
3 =  FORMAT DRIVE
4 = QUALIFY DRIVE
5 = MANUAL REPLACE BAD SECTORS
6 = TEST DRIVE (READ, WRITE, AND VERIFY)
7 =  ADDITIONAL SCSI COMMANDS

SELECT OPTION :
```

Figure 4-1: PDP Main Menu

NOTE If the message appears "CONTROLLER NOT PRESENT," make sure CSR address is correct.

6 From the PDP Main Menu select option *1* or *7*. *1* will boot the drive and *7* will bring you to the SCSI Host Adapter Utility.

PDP-11/34 Systems

Follow these instructions for using the Disk Utility with PDP-11/34 Systems.

1 Enter ODT mode.

2 From the terminal, enter the following commands and press **[ENTER]** after each command:

```
L YYYYYY
D 123456

L YYYYYY
D 100
```

Where
YYYYYY = the last six digits of the CSR address plus 2 (see Table 4-1)

3 Enter the following commands and press **[ENTER]** after each command; the Utility program will the begin executing as shown in Figure 4-1:

```
L 5000
S
```

EXAMPLE For steps **2** and **3** with CSR address 17772150, enter:

```
L 772152   [ENTER]
D 123456   [ENTER]
L 772152   [ENTER]
D 100  [ENTER]
L 5000
S
```

Accessing the Utility Through the RS-232 Port

To access the utility from the RS-232 port, follow the instructions below.

1 Connect a terminal to the CDU-720's RS-232 port (10 pin connector). See Figure 4-2.

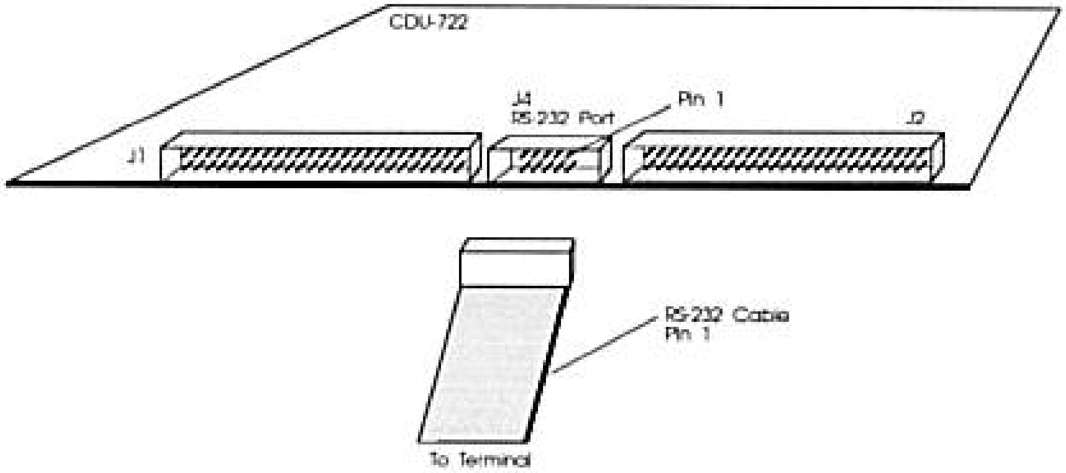


Figure 4-2: CDU-720 RS-232 Port

2 Set the terminal baud rate to 9600 (8-bit data, 1-stop bit, no parity) jump scroll.

3 Halt the system's CPU, reset the system, and hit carriage return on the terminal. The SCSI Host Adapter Utility will display as shown in Figure 4-3.

```
SCSI HOST ADAPTER UTILITY (REV. YYYxZZ)

X = UTILITY EXIT

[DISK]                               [TAPE]
1 = LOGICAL UNIT NUMBER OFFSET       6 = LOGICAL UNIT NUMBER OFFSET
2 = FORMAT DRIVE                     7 = ADDITIONAL UTILITIES
3 = QUALIFY DRIVE
4 = MANUALLY REPLACE BAD BLOCKS
5 = ADDITIONAL UTILITIES

SELECT OPTION ?
```

Figure 4-3: SCSI Host Adapter Utility

Once the SCSI Host Adapter Utility shows up, you can key in the number to select the desired option. Press **[CTRL] + C** at any time to return to the main menu.

4 Refer the next subsections for configurations. When completed, unplug the terminal, reset the system, and boot. DO NOT use the On-Board Utility while the system is running.

NOTE The following sections will illustrate the On-Board Utility from the RS-232 Port. There may be some variation in the Main Menu and the SCSI Host Adapter Utility Menu. If you are accessing from the Main Menu, simply chose the correct number for each option.

Changing LUN Offset

When a system has a HSC or in a VAX cluster it will be necessary to change the LUN (Logical Unit Number) offset. Each MSCP drive requires a different Unit Number so that the unit numbers are not duplicated. If there are no other MSCP controllers in the system, the LUN offset can be 0.

If there exists another MSCP controller with four drives (0 to 3) in a VAX cluster configuration, then the LUN offset should be four or above. In the case that LUN offset is equal to 10, SCSI ID 0 will be DUB10 and SCSI ID 1 will be DUB11. The drives will show up as such DUA0, DUA1, DUA2, DUA3, DUB10, DUB11 (see section, "SCSI ID for Target Drives" in Chapter 3 for explanation).

Follow these procedures to configure LUN offset.

1 Select option *1* from the SCSI Host Adapter Utility for disk drives; *6* for tape drives.

2 Enter the new value for LUN offset at the statement: LUN OFFSET IS 0, ENTER NEW VALUE:

3 At the statement: SAVE NEW VALUE (Y or N)? enter *Y*.

4 The monitor will display FORMAT COMPLETE when finished executing.

Formatting the Drive

This section details formatting a drive. The CDU-720 issues Format Unit Command to the selected SCSI disk drive and requests it to map out the defects on the Manufacture Defect List (MDL). Remember formatting a drive will rewrite all the sectors of that drive.

CMD recommends that you format all new drives. To format a drive, follow the steps below:

1. Select option 2 from the SCSI Host Adapter Utility.
2. Enter the device number from 0 to 6 in the statement: DEVICE NUMBER? <0 TO 6> DEV X.
3. Answer *Y* to the question FORMAT DRIVE X, ARE YOU SURE? if you want to continue.
4. At the statement: WARNING DATA WILL BE DESTROYED, ARE YOU SURE? enter *Y* if you want to continue.
5. The monitor displays WAIT while the drive is executing the format process.
6. The monitor will display COMPLETE when finished executing.

Qualifying the Drive

After formatting the device, CMD recommends you qualify devices by running this procedure at lease once without errors detected. The qualify program writes different patterns to the drive and then verifies the data. If there are any bad sectors, the sectors will automatically be replaced and the statement XX XXXXXXXX BAD BLOCK REPLACED will appear. Follow the instructions below for qualifying a drive.

1. Select option *3* from the SCSI Host Adapter Utility.
2. Enter the device number at the statement: DEVICE NUMBER? DEV <0 TO 6> DEV X.
3. At the statement, READY TO TEST DEVICE X, ARE YOU SURE enter *Y* if you want to continue.

4 At the statement: *** WILL DESTROY DATA ON THIS DEVICE, ARE YOU SURE? enter *Y* if you want to continue.

5 The monitor will display QUALIFY STARTED <SEQUENTIAL WRITE & READ>! <HIT <Break> TO ABORT>.

6 The monitor will display TESTING LOOP COUNT & BLOCK NUMBER:

7 Press **[BREAK]** to exit back to the SCSI Host Adapter Utility after you are satisfied with the qualifying process.

Manually Replacing Bad Sectors

This option allows you to replace bad sectors manually. The controller supports dynamic defect management which replaces defective sectors on-line so there is no need to manually replace bad sectors. However, if you wish to replace bad sectors manually follow these instructions; remember that any data in the sector will be lost:

1 Select option 4 from the SCSI Host Adapter Utility.

2 Enter the device number at the statement: DEVICE NUMBER ? DEV <0 TO 6> DEV X:

3 Enter the logical block number in HEX at the statement:

```
READY TO TEST DEVICE X,
ENTER THE BAD BLOCK NUMBER <HEX> : xxxxx
```

4 The monitor will display --BAD BLOCK REPLACED-- when finished executing.

Additional Utilities

To access additional utilities for disk drives, select option **5** from the main menu. To access additional utilities for tape drives, select option **7** from the main menu. The additional utilities menu will display as shown in Figure 4-4.

```
ADDITIONAL UTILITIES   (REV. YYYxZZ)   SN = 1278

D = DISPLAY SCSI DEVICE AND SET UP CONFIGURATION
S = SEND SCSI COMMAND TO THE DEVICE
T = TEST SCSI DEVICE
R = FORMAT RCT BLOCK

SELECT OPTION ?
```

Figure 4-4: Utility Sub-menu

Displaying SCSI Device and Setting Up Configuration

Selection 'D' can be used to change the controller default configurations such as those listed below:

- reset to default
- number of disk and tape devices supported
- SCSI reset enable/disable
- SCSI disconnect enable/disable
- sync/async mode selection
- tape buffer mode enable/disable
- prevent medium removal enable/disable
- disk write with verify enable/disable
- remote density mode enable/disable
- default tape enable/disable
- reconfigure device
- autoboot start from floppy enable/disable
- write protect from controller jumper setting
- truncate disk size for volume shadowing
- eject removable disk cartridge after dismount

This utility can also scan/display the SCSI devices attached to the CDU-720. The CDU-720/TM will be shown as an example in the following display. To display SCSI devices and set up configuration follow the procedures below:

1 Select option *D* at the sub-menu (Figure 4-4), the following current configuration is displayed as shown in Figure 4-5.

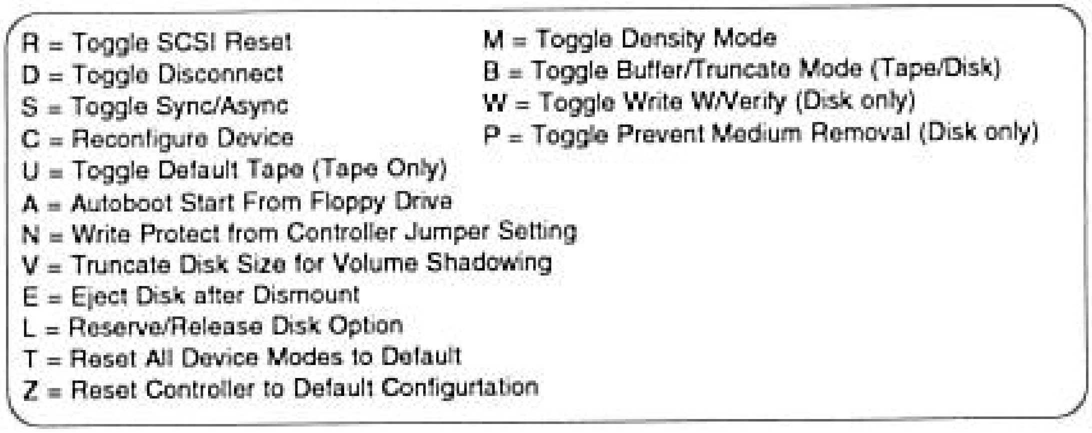
```
DEV0   DU0, SCSI ID 0, LUN 0
       Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV1   DU1, SCSI ID 1, LUN 0
       Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV2   DU2, SCSI ID 2, LUN 0
       Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV3   DU3, SCSI ID 3, LUN 0
       Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV4   MU0, SCSI ID 4, LUN 0
       Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV5   MU1, SCSI ID 5, LUN 0
       Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV6   MU2, SCSI ID 6, LUN 0
       Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV7   SCSI ID 7, HOST ADAPTER SCSI Reset ON, Density Mode ON, Default Tape OFF
       Boot Floppy OFF, Jumper Write Protect OFF, Eject Disk ON, Truncate Size OFF
```

Figure 4-5: Current configuration, default

NOTE If Truncate Size is toggled, "Truncate Mode ON" will display under each disk device options and at the bottom when configuration is displayed.

2 To change the configuration, enter ***Y*** at the statement: CHANGE CONFIGURATION ? (Y/N) The menu shown in Figure 4-6 will display.

NOTE See subsection, "Unit Numbering" before trying to reconfigure devices.



```
R = Toggle SCSI Reset                        M = Toggle Density Mode
D = Toggle Disconnect                        B = Toggle Buffer/Truncate Mode (Tape/Disk)
S = Toggle Sync/Async                        W = Toggle Write W/Verify (Disk only)
C = Reconfigure Device                       P = Toggle Prevent Medium Removal (Disk only)
U = Toggle Default Tape (Tape Only)
A = Autoboot Start From Floppy Drive
N = Write Protect from Controller Jumper Setting
V = Truncate Disk Size for Volume Shadowing
E = Eject Disk after Dismount
L = Reserve/Release Disk Option
T = Reset All Device Modes to Default
Z = Reset Controller to Default Configurtation
```

Figure 4-6: Configuration change

The following list is an explanation of the selections in Figure 4-6.

R = Toggle SCSI reset—Choosing this option will toggle the controller's ability to issue SCSI resets. This should be turned off when multi-hosting is desired.

D = Toggle Disconnect—This option allows you to enable or disable disconnect for each device. If enabled the controller will indicate its ability to disconnect during the SCSI identify message.

S = Toggle Sync/Async—This option allows you to configure each device for synchronous or asynchronous operations. If synchronous is selected, the controller will attempt a synchronous message exchange with the device. If the device accepts the message exchange, they will transfer data synchronously, otherwise they will transfer asynchronously.

C = Reconfigure Device—This option allows you to reconfigure the device at any time.

M = Toggle Density Mode—This option allows you to configure the controller for remote density selection. If enabled, remote density selection may take place. If enabled, the controller reports itself as a 'TU81.' If disabled, it reports itself as a 'TK50.'

B = Toggle Buffer/Truncate Mode (Tape/Disk)—For tape devices, this option allows the controller to configure each individual tape device for write caching. If enabled, the tape device will send command complete message and good status to the controller once the data as been transferred to the tape device's internal buffers. If disabled, such message and status will be sent when the data is actually written to the tape. For disk devices, you may toggle truncate disk size, see "V = Truncate Disk Size for Volume Shadowing" for explanation.

W = Toggle Write W/Verify—This option will allow the SCSI command Write with Verify to be issued for MSCP write with verify modifier. When set to OFF (which is the default), the normal write command will be issued.

P = Prevent Medium Removal—This option is for removable disk drives only. When set to ON, a "Prevent Medium Removal" will be issued to a drive when it is mounted by VMS. This will disable the eject media push-button in front of the drive. An "Allow Medium Removal" will be issued when the drive is dismounted by VMS and the push-button will be enabled. This features can be disabled and the media can be ejected at anytime.

U = Toggle Default Tape—This option allows you to force the presence of a tape unit to the operating system even if one does not exist. This is needed for some operating systems when the controller is connected to devices with a long self test procedure after power-up. If it is disabled, only units connected to the controller are seen by the operating system.

A = Autoboot Start From Floppy Drive—This option allows you to set the system to boot directly from the first floppy drive; if no floppy drive is present, the system will begin to boot from the first device.

N = Write Protect from Controller Jumper Setting—This option is not available at the present time. Default is OFF.

V = Truncate Disk Size for Volume Shadowing—This option allows the size of the disk to be truncated to multiples of 126 blocks to allow VMS volume shadowing copy process to reach higher performance. The message "** WARNING ** Truncate Size ON/OFF will be toggled, Are you sure?" will display before truncate switch can be toggled. If this feature is used on a disk that contains valid data, the data must be removed and later restored after turning this feature ON.

E = Eject Disk after Dismount—This option allows you to specify whether the removable disk cartridges will eject from the drive after dismount.

L = Reserve/Release Disk Option—This option is to let the MSCP ON-LINE exclusive use modifier to be operable.

T = Reset all Device Modes to Default—These modes are—disconnect, synchronous, Prevent Medium Removal, Write with Verify, and Buffer modes, etc.

Z = Reset Controller to Default Configuration—This option allows the you to set the controller to its factory default configuration. This will set the CDU-720/TM to support four disk drives, three tape drives; the CDU-720/M to support seven disk drives; CDU-720/T to support seven tape drives; disconnect, SCSI reset, synchronous communication, buffer mode, prevent medium removal and density selection enabled; write with verify, write protect disabled, reserve/release disk disabled, and default tape disabled. Use this feature **ALWAYS** before you reconfigure the board.

3 To reconfigure the device select option C and the screen will prompt you to answer the next series of questions as shown in Figure 4-7.

4 Enter the number of disk and/or tapes. Default configuration is four disks, and three tapes; it is not necessary to configure if running less than four disks and three tapes.

```
Number of Disks? (0-7)     4
   DU0 to be Reconfigured ? (Y/N)   N
   DU1 to be Reconfigured ? (Y/N)   N
   DU2 to be Reconfigured ? (Y/N)   N
   DU3 to be Reconfigured ? (Y/N)   N

Number of Tapes? (0-3)     3
   MU0 to be Reconfigured ? (Y/N)   N
   MU1 to be Reconfigured ? (Y/N)   N
   MU2 to be Reconfigured ? (Y/N)   N
```

Figure 4-7: SCSI host adapter ID change

NOTE If zero is selected for the number of disks or tapes disable the corresponding CSR address as shown in Tables 3-1 to 3-4 (Chapter 3). **Do not use 0 disk and/or 0 tape configuration in the above setup.**

Answer *Y* or *N* to reconfigure each of the disks or tapes. If you answer *Y*, the screen will prompt you with these questions:

```
DUX SCSI ID? <0-7>
DUX LUN? <0-3>
```

Figure 4-8: Disk and Tape Configuration Change

NOTE This LUN is SCSI LUN; it is normally 0. This is used only for devices that support multiple LUNs.

5 When you have completed these instructions the display will show your current configuration and prompt you again with the question CHANGE CONFIGURATION ? (Y/N). Enter *N*; this will cause the CDU-720 to scan the SCSI bus.

The utility will display your current configuration with manufacturer's name, model number, and firmware revisions for each device. Record this information for future use.

Sending SCSI Commands To The Device

Selection 'S' can be used to send SCSI commands to the selected disk/tape drives directly.

This option is used to send a 6-, 10-, or 12-byte command to a SCSI device. Follow these procedures to send SCSI commands to the device:

1 Enter *S* from the "Additional Utilities" Menu. (Be sure you have correctly selected either *5* from the SCSI Host Adapter Utility for disk drives, or *7* for tape drives.)

2 At the question DEVICE NUMBER ? DEV <0-6> DEV enter the device number.

3 Enter the command sequence at the statement:

```
READY TO TEST DEVICE X
    EDIT CDB <HEX>  ***<ESC> TO TERMINATE EDITING***
    BYTE  0000= 00
```

If a 6- or 10-byte command is used, press **[ESC]** to terminate command editing. If a 12-byte command is used, command editing is terminated automatically.

4 At the statement WRITE DATA TO THE DEVICE ? <Y OR N> enter *N* to immediately send the command if SCSI command does not require a data out phase.

Or enter *Y* to send data to the device after the command phase if SCSI command requires a data out phase. Enter the data and enter **[ESC]** to terminate editing. The statement SAVE EDITED DATA IN BUFFER ? <Y OR N> will appear. Enter *Y* to save data in the buffer; or enter *N* to erase edited data after the command is sent.

Testing SCSI Device

Selection 'T' can be used to read only, write and read selected disk drive, and/or write and read selected tape drive continuously. This is a diagnostic tool to help with installation and testing. Follow the procedures below to test the SCSI device.

1 Enter *T* from the "Additional Utilities" menu. (Be sure you have correctly selected either *5* from the SCSI Host Adapter Utility for disk drives, or *7* for tape drives.)

2 At the question DEVICE NUMBER ? DEV <0-6> DEV enter the device number.

3 When testing for *disk devices*, at the statement READY TO TEST DEVICE X, DO YOU WANT TO READ ONLY ? <Y OR N> enter *Y* to read only.

Enter *N* to write and read. The question ARE YOU SURE? will display. Enter *Y* to write and read to the device.

WARNING ***N* will destroy all data on the device.**

When testing for *tape devices*, the statement ARE YOU SURE? will display. Enter *Y* to test the device.

4 At the statement, IS THIS FOR DUAL HOSTS QUALIFICATION TEST? <Y/N>, enter *Y*. Enter *N* for single host qualification.

The test will continue until you abort. Allow the test to continue for a few minutes for new devices and ten minutes for suspected bad devices. Press **[BREAK]** or **[CTRL] + C** to abort and exit back to the SCSI Host Adapter Utility.

Formatting RCT Block

Selection 'R' can be used to format the RCT blocks of the disk drive selected. This command writes zeros in the last logical block of the device. If you try to skip the formatting process and directly use the drive, you *must* use this option to eliminate "unrecoverable bad RCT block." However, CMD recommends you format the drive. To format the RCT block follow these instructions:

1 Select *R* from the "Additional Utilities." (Be sure you have previously selected *5* from the SCSI Host Adapter Utility for disk drives.)

2 Enter device number at the statement: DEVICE NUMBER? DEV <0-6> DEV.

If device is off-line the following statement will appear, DEVICE OFFLINE, RESELECT OR PROCEED ? (R/P). Enter *R* to reselect or *P* to proceed.

3 FORMAT COMPLETE will display when RCT block has been formatted.

Completing Utility Functions

The following procedures should be completed when you have accessed the On-Board Utility through the RS-232 port.

1 Use the On-Board Utility to verify SCSI cable and SCSI devices connected to the CDU-720 after installing the CDU-720 in the Unibus slot.

2 After verifying the SCSI connections, disconnect RS-232 cable from the back panel, and reset the system.

NOTE If the terminal is connected, this may cause the On-Board Utility to be invoked during system operation and will take control of the Host Adapter from VMS.

The following procedures should be completed when you have accessed the On-Board Utility through the Virtual Console of the LSI or VAX systems.

1. Use the On-Board Utility to verify the Unibus slot seating, SCSI cable, and SCSI devices connected to the CDU-720 after installing the CDU-720 in the Unibus slot.
2. After verifying the SCSI connections, reset the system.

Unit Numbering For Devices

This section explains configuring unit numbers. Unit numbers may be changed by using the "Configure LUN Offset" from the main menu. If you used the 'D' option from the "Additional Utilities" menu, the terminal will display the *MU* and/or *DU* numbers as shown in Table 4-2, factory default settings for unit numbers.

Table 4-2 Default for Unit Numbers

CDU-720/T	SCSI ID	On-Board Utility	Operating System Unit No.
	0	MU0	0
	1	MU1	1
	2	MU2	2
	3	MU3	3
	4	MU4	4
	5	MU5	5
	6	MU6	6
CDU-720/M	**SCSI ID**	**On-Board Utility**	**Operating System Unit No.**
	0	DU0	0
	1	DU1	1
	2	DU2	2
	3	DU3	3
	4	DU4	4
	5	DU5	5
	6	DU6	6
CDU-720/TM	**SCSI ID**	**On-Board Utility**	**Operating System Unit No.**
	0	DU0	0
	1	DU1	1
	2	DU2	2
	3	DU3	3
	4	MU0	0
	5	MU1	1
	6	MU2	2

An example on the next page is given for each type of controller to show how the unit numbers can be determined. Refer to Figure 4-5 if necessary.

CDU-720/T—Tape drives must be configured starting from SCSI ID 0 to properly use the information from Table 4-2. *MU0* will be unit number 0; this is with LUN offset set to 0. Setting the LUN offset to 10 will change the *MU* number to 10 (ie., *MU10*), making the unit number 10.

CDU-720/M—Disk drives must be configured starting from SCSI ID 0 to properly use the information from Table 4-2. *DU0* will be unit number 0. This is with LUN offset set to 0. Setting the LUN offset to 10 will change the *DU* number to 10 (ie., *DU10*), making the unit number 10.

CDU-720/TM—Default is four disk drives and three tape as shown in Table 4-2. If you have more than four disk drives or three tape drives, follow these guidelines—disk drives must start at SCSI ID 0 and tape drives must start after the last disk drive's SCSI ID number and reconfigure the CDU-720/TM (see subsection, "Displaying SCSI Devices and Setting Up Configuration"). Note the example below:

SCSI ID 0 disk
SCSI ID 1 disk
SCSI ID 2 disk
SCSI ID 3 disk
SCSI ID 4 disk

SCSI ID 5 tape
SCSI ID 6 tape

SCSI ID 7 is initiator (CDU-720/TM)

The *MU* and *DU* numbers are the unit numbers mapped back to the operating system. If the CDU-720/TM is configured following these guidelines, you can apply this formula to determine the unit number mapped back to the operating system:

SCSI ID of the disk drive
+ the LUN offset for disk
= unit number for disk

SCSI ID of tape drive
– number of disk drives
+ LUN offset for tapes
= unit number for tape

Multi-Hosting Configuration

The following is a list of software requirements for multi-hosting; refer to Appendix A for supported multi-hosting devices:

- VMS version 5.3 or above
- VAX cluster software must be running on both systems with at least one of the DEC's interconnects operational
- Tape drives can only be mounted to one system at a time
- Allocation classes must be the same for all systems when installing disk drives (value must not equal 0).

Using VMS and the CDU-720/M or CDU-720/TM, you can multi-host by following the instructions below:

1 Configure the CDU-720 to SCSI ID 7 for the first computer; configure the CDU-720 to SCSI ID 6 for the second computer. If you need to alter the Host Adapter SCSI ID change the jumper settings as shown in Table 4-3.

Table 4-3 Host Adapter ID Selection

W6-1	W6-2	W6-3	Initiator ID
IN	IN	IN	Host adapter ID = 7 highest priority (F)
IN	IN	OUT	Host adapter ID = 6
IN	OUT	IN	Host adapter ID = 5
IN	OUT	OUT	Host adapter ID = 4
OUT	IN	IN	Host adapter ID = 3
OUT	IN	OUT	Host adapter ID = 2
OUT	OUT	IN	Host adapter ID = 1
OUT	OUT	OUT	Host adapter ID = 0, lowest priority

Note that (F) means factory setting.

2 From the Additional Utilities Menu in the On-Board Utility, follow these instructions:

- **a** Select option *D* to display current configuration.
- **b** Answer *Y* to the statement: CHANGE CONFIGURATION ? (Y/N) The menu shown in Figure 4-5 will display.
- **c** Select **Z** to reset configuration back to default.
- **d** Answer *Y* to reconfigure the adapter.

NOTE If you ever reconfigure the board, you must reset the configuration to default using selection Z.

- **e** Select *R* to toggle SCSI reset. Then set the SCSI reset to OFF. Do this for all SCSI host adapters to be multi-hosted.
- **f** Answer *Y* to reconfigure the adapter.
- **g** Select *C* to reconfigure the device. Then configure the CDU-720 for exact number of disks and tapes. This will inhibit scanning of other host adapters (see Figure 4-5).
- **h** If other MSCP disks are in the cluster, follow the rules in the subsection "Changing LUN Offset" in "On-Board Utility" so that each device has a unique unit number.
- **i** Exit out of the On-Board Utility.

NOTE In a multi-hosting system the *physical* disk device name must be identical on both systems.

3 Terminate both *physical* ends of the SCSI bus.

Single-ended—If the CDU-720 is at either end of the SCSI bus, remove on-board terminators, RN9, RN10, RN14, and use a pass-through terminator as close to the board as possible. If the CDU-720 is in the middle of the SCSI bus, RN9, RN10 and RN14 terminators *must* be removed, *do not* use pass through terminators.

Differential—If the CDU-720 is at either end of the SCSI bus, remove on-board terminators, RN1, RN2, RN3, RN4, RN5, RN6, RN7, RN8 and use a pass-through terminator as close to the board as possible. If the CDU-720 is in the middle of the SCSI bus, RN1, RN2, RN3, RN4, RN5, RN6, RN7, and RN8 terminators *must* be removed, *do not* use pass through terminators.

In the event that one system becomes inoperable with only two nodes in the VAX cluster, a quorum disk must be used to count as a vote; this keeps the other system running. Refer to VMS VAXcluster manual order number AA-LA27A-TE to set up a quorum disk and a VAX cluster.

NOTE When running *cluster_config.com* on a system with only Ethernet as a computer interconnect, answer *Yes* for the question, "WILL THIS BE A SATELLITE NODE?"

Partitioning Configuration

You may partition a device into two or four sections under VMS or ULTRIX using the CDU-720/M or CDU-720/TM. To partition a device, follow the instructions below.

1 Configure the SCSI devices as explained in the section "Displaying SCSI Device and Setting Up Configuration."

2 Select *D* from "Additional Utilities." The current configuration will display all physical devices as shown in the example in Figure 4-9:

```
DEV0  DU0, SCSI ID 0, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF
DEV1  DU1, SCSI ID 1, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF
DEV2  DU2, SCSI ID 2, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF
DEV3  DU3, SCSI ID 3, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF
DEV4  MU0, SCSI ID 4, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON
DEV5  MU1, SCSI ID 5, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON
DEV6  MU2, SCSI ID 6, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON
DEV7  SCSI ID 7, HOST ADAPTER SCSI Reset ON, Density Mode ON, Default Tape OFF
      Boot Floppy OFF, Jumper Write Protect OFF, Eject Disk ON, Truncate Size OFF
```

Figure 4-9: Current configuration

3 Answer **Y** to the question that appears on the screen: CHANGE CONFIGURATION (Y/N)? Figure 4-10 will display:

```
R = Toggle SCSI Reset                      M = Toggle Density Mode
D = Toggle Disconnect                      B = Toggle Buffer/Truncate Mode (Tape/Disk)
S = Toggle Sync/Async                      W = Toggle Write W/Verify (Disk only)
C = Reconfigure Device                     P = Toggle Prevent Medium Removal (Disk only)
U = Toggle Default Tape (Tape Only)
A = Autoboot Start From Floppy Drive
N = Write Protect from Controller Jumper Setting
V = Truncate Disk Size for Volume Shadowing
E = Eject Disk after Dismount
T = Reset All Device Modes to Default
Z = Reset Controller to Default Configurtation
```

Figure 4-10: Configuration change

4 Select **Z** to reset configuration back to default. Answer **Y** to reconfigure the adapter. This step is **IMPERATIVE!**

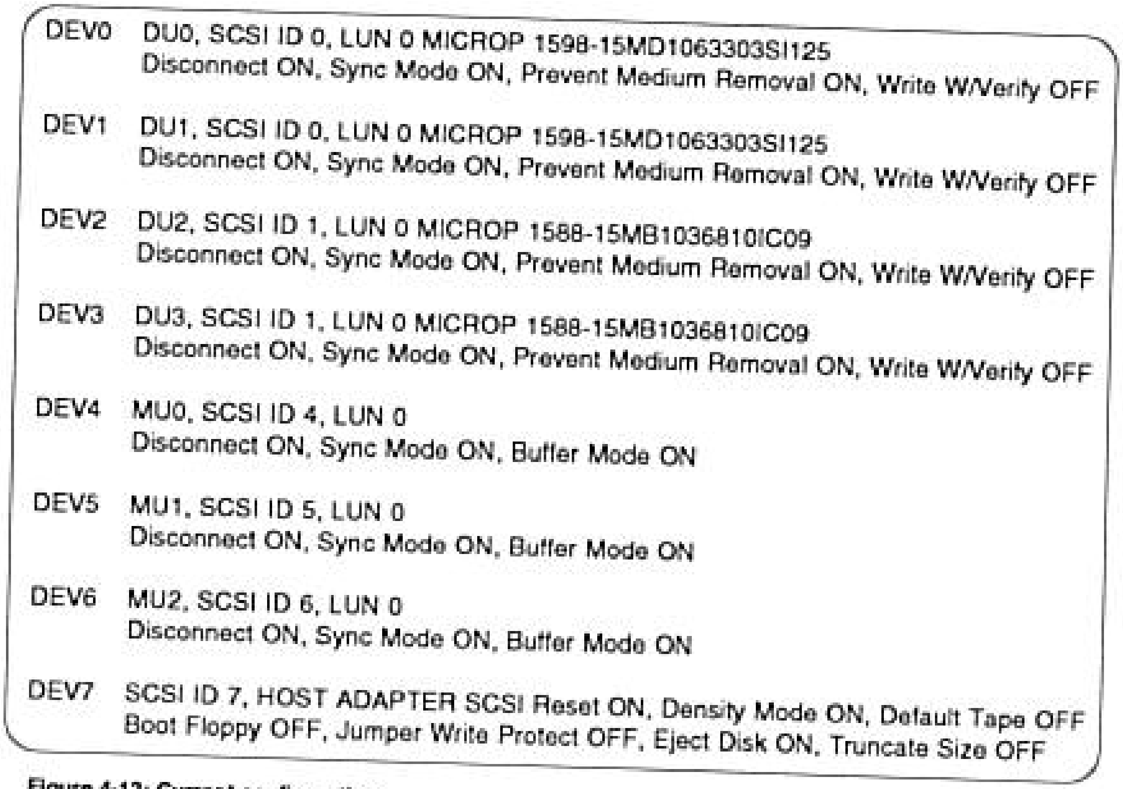
NOTE If you ever reconfigure the board, you must reset the configuration to default using selection Z.

5 Select Option C. Answer **Y** to the devices to be partitioned as shown in the example in Figure 4-11:

```
Number of Disks? (0-7)     4                          [total number of logical disks]
   DU0 to be Reconfigured ? (Y/N)    Y
   DU0 SCSI ID ? (0-7)   0
   DU0 LUN ? (0-3)   0
   Number of Partitions  ?  (NONE, 2, 4)  2     [N is the default]
   DU2 to be Reconfigured ? (Y/N)    Y
   DU2 SCSI ID ? (0-7)   1
   DU2 LUN ? (0-3)   1
   Number of Partitions  ?  (NONE, 2, 4)  2     [N is the default]

Number of Tapes? (0-3)     3
   MU0 to be Reconfigured ? (Y/N)    N
   MU1 to be Reconfigured ? (Y/N)    N
   MU2 to be Reconfigured ? (Y/N)    N
```

Figure 4-11: Partitioning example

After you have completed configuration, the system will display device configuration as shown in the example in Figure 4-12:



```
DEV0  DU0, SCSI ID 0, LUN 0 MICROP 1598-15MD1063303SI125
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV1  DU1, SCSI ID 0, LUN 0 MICROP 1598-15MD1063303SI125
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV2  DU2, SCSI ID 1, LUN 0 MICROP 1588-15MB1036810IC09
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV3  DU3, SCSI ID 1, LUN 0 MICROP 1588-15MB1036810IC09
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV4  MU0, SCSI ID 4, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV5  MU1, SCSI ID 5, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV6  MU2, SCSI ID 6, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV7  SCSI ID 7, HOST ADAPTER SCSI Reset ON, Density Mode ON, Default Tape OFF
      Boot Floppy OFF, Jumper Write Protect OFF, Eject Disk ON, Truncate Size OFF
```

Figure 4-12: Current configuration

6 Format RCT block for each partition of each device. See "Formatting RCT Block" in "Additional Utilities."

7 Exit out of the On-Board Utility.

NOTE The system considers each partition as a device even though the location (LUN) is the same.

Hardware Shadowing Configuration

This section explains how to configure the CDU-720/TMS and SCSI drives into shadow sets. A maximum of three shadow sets can be formed with each controller. For the purpose of this explanation, four disk drives will be divided into two shadow sets with three remaining tape drives as shown below:

DU0 = SCSI ID 0 Primary
DS0 = SCSI ID 1 Shadow drive of DU0
DU1 = SCSI ID 2 Primary
DS1 = SCSI ID 3 Shadow drive of DU1
MU0 = SCSI ID 4
MU1 = SCSI ID 5
MU2 = SCSI ID 6

Configuration Instructions

Follow the instructions below for configuring shadow sets.

1. Select 5 from the SCSI Host Adapter Utility.
2. Select *D* from the "Additional Utilities" to display current configuration.
3. Answer *Y* to the question: CHANGE CONFIGURATION ? (Y/N). The menu shown in Figure 4-5 will display.
4. Select **Z** to reset configuration back to default. Answer *Y* to reconfigure the adapter. This step is **IMPERATIVE!**

NOTE If you ever reconfigure the board, you must reset the configuration to default using selection Z and then reconfigure.

5 Select **C** to reconfigure the device; see Figure 4-13 for instructions.

```
Number of Disks (including shadow units)? (0 - 7)    4
Number of Shadow sets ? (0 - 2)   2
   DU0 to be Reconfigured ? (Y/N)    Y
   DU0 SCSI ID ? (0 - 7)   0
   DU0 LUN ? (0 - 3)   0
Shadow units exist ? (Y/N)   Y
   DS0 SCSI ID ? (0 - 7)   1
   DS0 LUN ? (0-3)   0
   DU1 to be Reconfigured ? (Y/N)    Y
   DU1 SCSI ID ? (0 - 7)   2
   DU1 LUN ? (0 - 3)   0
Shadow units exist ? (Y/N)   Y
   DS1 SCSI ID ? (0 - 7)   3
   DS1 LUN ? (0-3)   0

Number of Tapes? (0-3)      3
   MU0 to be Reconfigured ? (Y/N)   Y
   MU0 SCSI ID ? (0 - 7)   4
   MU0 LUN ? (0 - 3)   0
   MU1 to be Reconfigured ? (Y/N)   Y
   MU1 SCSI ID ? (0 - 7)   5
   MU1 LUN ? (0 - 3)   0
   MU2 to be Reconfigured ? (Y/N)   Y
   MU2 SCSI ID ? (0 - 7)   6
   MU2 LUN ? (0 - 3)   0
```

Figure 4-13: Hardware Shadowing example

6 After you have completed configuration, the system will display device configuration as shown in the example in Figure 4-14:

```
DEV0   DU0, SCSI ID 0, LUN 0
       Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV1   DU1, SCSI ID 2, LUN 0
       Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV2   DS0, SCSI ID 1, LUN 0
       Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV3   DS1, SCSI ID 3, LUN 0
       Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV4   MU0, SCSI ID 4, LUN 0
       Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV5   MU1, SCSI ID 5, LUN 0
       Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV6   MU2, SCSI ID 6, LUN 0
       Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV7   SCSI ID 7, HOST ADAPTER SCSI Reset ON, Density Mode ON, Default Tape OFF
       Boot Floppy OFF, Jumper Write Protect OFF, Eject Disk ON, Truncate Size OFF
```

Figure 4-14: Current configuration

7 Then answer *N* to the question: CHANGE CONFIGURATION ? (Y/N) and exit out of the On-Board Utility.

Detecting Shadowing Errors Using VMS

The following instructions will help you detect shadowing errors and shadowing drive failure.

1 At the system prompt, enter *show dev du.*

2 Check the error count for shadowed disk drives.

3 If errors are detected, follow the instructions given in Appendix C, "Troubleshooting," to view "Controller Dependent Information."

Look for information describing which drive has failed such as given below:

/ID x/
/LUNx/
/PORx/

Where:
x is the variable used to represent the ID, LUN, and Port of the failed disk drive.

4. Back up the remaining good shadow set member.
5. Shut down the system.
6. Replace the drive.
7. Enter the On-Board Utility and follow these instructions:
    - a Select option ***D***. The current configuration will display.
    - b Answer ***Y*** to the question: DO YOU WANT TO CLEAR SHADOW FAILED STATUS ? <Y/N>
    - c Answer ***N*** to the question: CHANGE CONFIGURATION <Y/N>
    - d Exit On-Board Utility.
8. Boot the system.
9. Initialize the specified shadow set in VMS.
10. Restore the backup copy to the specified shadow set.
11. Put the specified drives back on-line by mounting them to VMS.

VMS Configuration

If you followed procedures in "Determining CSR Address" in Chapter 3, VMS software will automatically configure new devices added. *NO* other configuration is required. If VMS does not, run Auto Configure as shown in Appendix D.

ULTRIX Configuration

VAX and DEC systems using ULTRIX software must be manually configured to access the CDU-720 boards.

First, examine current configuration file to determine which controllers and devices are already connected to the system. Then refer to the respective sections for configuration procedures for the CDU-720/T, CDU-720/M, CDU-720/TM.

CDU-720/T

Edit the configuration file by performing the following instructions for the CDU-720/T. Note, the CDU-720/T must be configured with a higher *klesiu number*, higher *uq number*, and higher *tms number* than any other *klesiu* controller in the configuration file.

1 Make sure the following two lines are in the configuration file:

```
adapter uba& at nexus?
```

Where
? = the system will fill in this variable (simply enter this ?).
& = the node ID of the Unibus adapter.

2 Connect the controller to the node on the Unibus by entering the following line:

```
controller klesiuϑ at uba&
```

Where
ϑ = the variable number that represents the CDU-720/T.
& = same number used in step 1.

3 Tell ULTRIX what the name of the controller will be:

```
controller uq# at klesiuϑ csr XXXXXXXX vector uqintr
```

Where
ϑ = the same number used in step 2.
# = the variable used to represent the controller.
XXXXXXXX = CSR address.

4 Name the tape drives and list drive unit by entering the following line:

```
tape tms0 at uq# driveα
tape tms1 at uq# driveβ
```

Where
# = the same number used to represent the controller in step 3.
α = the *MU* number in the On-Board Utility displays this configuration.
β = the *MU* number in the On-Board Utility displays this configuration different than α.

CDU-720/M

Edit the configuration file by performing the following instructions for the CDU-720/M. Note the CDU-720/M must be installed with a higher *node ID number*, higher *klesib number*, higher *ra number*, and higher *uq number* than any other *kdb* and *klesib* controller in the configuration file.

1 Make sure the following two lines are in the configuration file:

```
adapter uba& at nexus?
```

Where
? = the system will fill in this variable (simply enter this *?*).
& = the node ID of the Unibus adapter.

2 Connect the controller Unibus by entering the following line:

```
controller udaϑ at uba&
```

Where
ϑ = the variable number that represents the CDU-720/M.
& = the same number used in step 1.

3 Tell ULTRIX what the name of the controller will be:

```
controller uq# at udaϑ csr XXXXXXXX vector uqintr
```

Where
# = the variable used to represent the controller.
ϑ = the variable used in Step 2.
XXXXXXXX = CSR address.

4 Name the tape drives and list drive unit by entering the following line:

```
disk ra0 at uq# driveα
disk ra1 at uq# driveβ
```

Where

# = the same number used to represent the controller in step 3.

α = the *DU* number in the On-Board Utility displays this configuration.

β = the *DU* number in the On-Board Utility displays this configuration different than α.

CDU-720/TM

Edit the configuration file by performing the following instructions for the CDU-720/TM. Note the CDU-720/TM must be configured with a higher *klesiu number*, higher *uq number*, and higher *tms numbers* than any other *klesiu* controller; and a higher *uda number*, higher *uq number*, and higher *ra number* than any other *uba* controller in the configuration file.

1 Make sure the following two lines are in the configuration file:

```
adapter uba& at nexus?
```

Where

? = the system will fill in this variable (simply enter this *?*).

& = the node ID of the Unibus adapter.

2 Connect the controller the Unibus by entering the following line:

```
controller klesiuϑ at uba&
controller uda# at uba&
```

Where

ϑ = the variable number that represents the CDU-720/TM.

& = the same number used in step 1.

3 Tell ULTRIX what the name of the controller for the different functions will be:

```
controller uq∇  at  klesiuϑ csr XXXXXXXX vector  uqintr
controller uqΔ  at  uda#  csr XXXXXXXX vector  uqintr
```

Where
∇ = variable used to represent the controller.
Δ = variable used to represent the controller (unique from∇ above).
ϑ = the same number used in step **3** representing the controller.
# = the same number used in step **3** representing the controller.
XXXXXXXX = CSR address.

4 Name the tape drives and list drive unit by entering the following line:

```
tape  tms0  at  uq∇  driveα
tape  tms1  at  uq∇  driveβ
disk  ra0  at  uqΔ  driveα
disk  ra1  at  uqΔ  driveβ
```

Where
∇ = the same number used to represent the controller in step **4**.
Δ = variable used to represent the controller (unique from ∇ above).
α = the *MU* number in the On-Board Utility displays this configuration.
β = the *DU* number in the On-Board Utility displays this configuration.

5

SCSI Basics

This chapter consists of a SCSI glossary, SCSI commands used by the CDU-720 for MSCP and TMSCP emulation, SCSI status codes, SCSI messages, SCSI single-ended and differential signals.

SCSI Glossary

The following is a glossary of frequently used SCSI terms.

Connect—The function that occurs when an initiator selects a target to start an operation.

Disconnect—The function that occurs when a target release control of the SCSI bus, allowing it to go to the BUS FREE phase.

Initiator—A SCSI device (usually a host system) that requests an operation to be performed by another SCSI device.

LUN—Logic Unit Number.

Peripheral device—A peripheral that can be attached to a SCSI device (e.g., magnetic disk, magnetic tape, or optical disk).

Reconnect —The function that occurs when a target selects an initiator to continue an operation after a disconnect.

SCSI address—The octal representation of the unique address (0-7) assigned to an SCSI device. This address would normally be assigned and set in the SCSI device during system installation.

SCSI ID—The bit-significant representation of the SCSI address referring to one of the signal lines DB (7-0).

SCSI device—A host computer adapter or a peripheral controller or an intelligent peripheral that can be attached to the SCSI bus.

Target—A SCSI device that performs an operation requested by an initiator.

SCSI Commands

SCSI commands used by the CDU-720/TM for MSCP emulation are listed in Table 5-1.

Table 5-1 SCSI Commands (MSCP)

Code	Command Name
00h	Test Unit Ready
01h	Rezero Unit
03h	Request Sense
04h	Format Unit (1)
07h	Reassign Block
08h	Read
0Ah	Write
0Bh	Seek
12h	Inquiry
15h	Mode Select
16h	Reserve Unit
17h	Release Unit
1Ah	Mode Sense
1Bh	Start/Stop Unit
1Eh	Prevent/Allow Medium Removal
25h	Read Capacity
28h	Extended Read
2Ah	Extended Write
2Bh	Extended Seek
3Eh	Read Long (2)
3Fh	Write Long(2)

(1)The Format Unit command is used by the On-Board Utility only.

(2)These commands are used if the drives support them.

SCSI commands used by the CDU-720/TM for TMSCP emulation are listed in Table 5-2.

Table 5-2 SCSI Commands (TMSCP)

Code	Command Name
00h	Test Unit Ready
01h	Rewind
03h	Request Sense
08h	Read
0Ah	Write
10h	Write Filemarks
11h	Space
12h	Inquiry
15h	Mode Select
16h	Reserve Unit
17h	Release Unit
19h	Erase
1Ah	Mode Sense
1Bh	Load/Unload
1Eh	Prevent/Allow Medium Removal

SCSI Status

The SCSI status codes used by CDU-720 are listed in Table 5-3.

Table 5-3 SCSI Status

Code	Status Name
00h	Good
02h	Check Condition
08h	Busy
10h	Intermediate/Good
18h	Reservation Conflict

SCSI Messages

The SCSI Messages used by CDU-720 are listed in Table 5-4.

Table 5-4 SCSI Messages

Code	Message Name
00h	Command Complete
01h	Extended Message
02h	Save Data Pointer
03h	Restore Pointer
04h	Disconnect
05h	Initiator Detected Error
06h	Abort
07h	Message Reject
08h	No Operation
09h	Message Parity Error
80-FFh	Identify

SCSI Single-Ended Signals

This section illustrates the CDU-720 and CDU-722 pin assignments for the single-ended channel connector J1.

Figure 5-1 illustrates the pin locations of the CDU-720 SCSI device connector J1 and the CDU-722 connectors J1 and J2.

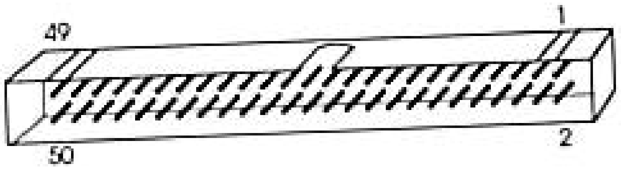


Figure 5-1: SCSI device connector

Table 5-5 shows the CDU-720 and CDU-722 single-ended SCSI connector pin assignments for J1.

Table 5-5 **Single-Ended Connector Pin Assignments (J1)**

Signal	Pin Number
-DB(0)	2
-DB(1)	4
-DB(2)	6
-DB(3)	8
-DB(4)	10
-DB(5)	12
-DB(6)	14
-DB(7)	16
-DB(P)	18
GROUND	20
GROUND	22
GROUND	24
TERMPWR	26
GROUND	28
GROUND	30
-ATN	32
GROUND	34
-BSY	36
-ACK	38
-RST	40
-MSG	42
-SEL	44
-C/D	46
-REQ	48
-I/O	50

NOTE All odd pins except pin 25 are connected to ground. Pin 25 is left open. The minus sign next to the signal indicates active low.

SCSI Differential Signals

This section illustrates the differential signals for the CDU-722 connector and pin assignments for J2. Table 5-6 shows the differential SCSI connector pin assignments (see Figure 5-1 for pin locations).

Table 5-6 Differential Connector Pin Assignments (J2)

Signal	Pin Number	Signal	Pin Number
GROUND	1	GROUND	2
+DB(0)	3	-DB(0)	4
+DB(1)	5	-DB(1)	6
+DB(2)	7	-DB(2)	8
+DB(3)	9	-DB(3)	10
+DB(4)	11	-DB(4)	12
+DB(5)	13	-DB(5)	14
+DB(6)	15	-DB(6)	16
+DB(7)	17	-DB(7)	18
+DB(P)	19	-DB(P)	20
DIFFSENS	21	GROUND	22
GROUND	23	GROUND	24
TERMPWR	25	TERMPWR	26
GROUND	27	GROUND	28
+ATN	29	-ATN	30
GROUND	31	GROUND	32
+BSY	33	-BSY	34
+ACK	35	-ACK	36
+RST	37	-RST	38
+MSG	39	-MSG	40
+SEL	41	-SEL	42
+C/D	43	-C/D	44
+REQ	45	-REQ	46
+I/O	47	-I/O	48
GROUND	49	GROUND	50

NOTE Shield ground is optional on some cables.

Appendix A

Supported Devices and Operating Systems

SCSI Devices

The following subsections list devices supported by the CDU-720. Contact CMD Technical Support for correct firmware revision for the drives listed; devices marked by the following symbols are qualified as follows:

italics	indicates new qualified device
bold	indicates device supports multi-hosting
bolded italics	indicates new qualified device supporting multi-hosting.

Magnetic disk drives supported by CDU-720/M and CDU-720/TM

SEAGATE	**WREN VI** , SWIFT (3-1/2-inch) SABRE 8-inch, **WREN VII,** ***WREN VIII, ELITE I & II (5400 RPM)***
CONNER	CP-3100, *CP3200*
CITOH	YD-3042, YD3082
DEC	*RZ23* , *RZ24* , *RZ56* , *RZ57*
FUJITSU	M2246SA Series, ***M2263SA***, M2249SA, M2266SA
HITACHI	**DK515C Series** , *DK516C*
HP	97548S/D series, C2233, C2234, C2235, C3010, C3009, C3007
IBM	320-MB, 3-1/2-inch
MAXTOR	XT-4000S Series, XT-8000S Series
MICROPOLIS	***1588-15***, 1598
QUANTUM	ProDrive 40S/80S
TEAC	*FD235HS (3-1/2-inch FLOPPY, DEC RX23 compatible)* *FD55GS (5 1/4-INCH FLOPPY, DEC RX33 compatible)*

More disk drives will be qualified soon.

Erasable Optical disk drives supported by CDU-720/M and CDU-720/TM

MAXOPTICS	Tahiti 1, Tahiti 2
SONY	**SMO-D501, SMO-D502, SMO-E501**
RICOH	*RO-5030E, RO-5030E2*

Erasable Optical disk cartridge manufacturers

SONY, RICOH, MAXOPTICS, PDO, 3M.

CD ROM disk drives supported by CDU-720/M and CDU-720/TM

DEC	RRD40 , RRD42
LMS	CM210, CM212
TOSHIBA	XM3200 series

WORM drives supported by CDU-720/M and CDU-720/TM

1 With Ten X Technology Optical Conversion Unit

All WORM drives supported by the optical conversion unit.

2 With LASERDRIVE interface

LASERDRIVE	Model 800 series

Tape drives supported by CDU-720/T and CDU-720/TM

1 8-mm helical scan tape drives

EXABYTE	**EXB-8200,** EXB-8500

2 4-mm DAT drives (Digital Audio Tape)

Archive	**Python 4520 DAT**
GIGATREND	1200 series DAT
HP	**35450A DAT,** 35470A, 35480A
SONY	**SDT-1000 DAT**
WangDat	**1300 DAT, 2600 DAT,** 3200 DAT
Wangtek	**6130 series DAT**

3 VHS helical scan tape drives

Digidata

Metrum

4 IBM-3480 compatible 18-track cartridge tape drives

ASPEN	System 480
FUJITSU	M2480 series, 2680
LMS	Independence
Storage Tech	4280 series (model Summit)
Cipher	T480

5 9 track reel to reel tape drives

Cipher	F880-II, M990, M995
HP	Model 88780B
KENNEDY	Model 9612
M4 data	Model 9914
STORAGE TECH	Model 2925, 9914
QUALSTAR	Model 340
TELEX	Model 9294
DEC	TSZ07

6 TK50 compatible tape drives

DEC	TZ30

Jukeboxes supported by CDU-720/TMJ

1 Disk Jukebox

Hewlett-Packard	*C1710A*
IDE	*7000*

2 Tape Jukebox

EXABYTE	EXB120

Operating Systems

All DEC-compatible products designed by CMD Technology, Inc. implement MSCP (Mass Storage Control Protocol)/TMSCP (Tape Mass Storage Control Protocol). CMD supports its implementation of MSCP/TMSCP beginning with the indicated version of the DEC operating systems listed in Table A-1.

Table A-1 Operating Systems Supported by CDU-720/722

VMS®	4.0 to 5.5
ULTRIX™	1.2 to 4.2
Unix/Berkeley™	4.2 to 4.3
RSX-11M	Disk 4.1-5.3, Tape 4.2-5.3
RSX-11M-Plus	3.0-4.3
RSTS/E	Disk 9.0-10.0, Tape 9.5-10.0
RT-11	Disk 5.1-5.5, Tape 5.4-5.5
DSM-11	3.3-4.1
ISM-11	3.4
TSX+	(see RT-11)
VAXELN	x.x
AT&T UNIX®	System V

Appendix B

Troubleshooting

VMS Analyze/Error Utility

The CDU-720 logs controller dependent information in *ERRLOG.SYS* file. You can use the VMS ANALYZE/ERROR Utility to open the file *ERRLOG.SYS* and display the error messages for troubleshooting. By including option switches such as */SINCE=DATE* and */INCLUDE=MUB0*, you may define the time reference and device. To enter the ANALYZE/ERROR Utility, log onto the system and enter the following command:

```
ana/err/since=[time]/include=[device]
```

Some examples are shown by the following:
To view all errors that VMS has logged, enter:

```
ana/err
```

To view the errors only on tape devices, enter:

```
ana/err/inc=tapes
```

To view the errors that have occured only on one tape unit (MUB0), enter;

```
ana/err/inc=mubo
ana/err/inc=(ptb,mubo)
```

To view the MUB0 errors that occured on April 20, 1990 since 14:22 (02:22 PM), enter:

```
ana/err/since=20-Apr-1989:14:22/inc=mubo
```

One example of the error log message is shown in below:

```
BEGINING OF INTERVENING ENTRIES
*************************ENTRY     6.**************************

                                               LOGGED ON SID 02005F78
ERROR SEQUENCE  9.
ERL$LOGMESSAGE ENTRY           20-APR-1989     10:21:55.41
                    KA750      REV# 120.       UCODE      REV# 95.

I/O SUB-SYSTEM, UNIT _MUA0:
MESSAGE TYPE              0002
                               TAPE MSCP MESSAGE

MSLG$L_CMD_REF        99730004
MSLG$W_SEQ_NUM            0001
                               SEQUENCE #1.

MSLG$B_FORMAT               00
                               CONTROLLER ERROR

MSLG$B_FLAGS                00
MSLG$W_EVENT              00E8 DATA ERROR
                               UNRECOVERABLE ECC ERROR


MSLG$Q_CNT_ID         00340000
                      03090000
                               UNIQUE IENTIFIER, 000000340000
                               TAPE CLASS DEVICE
                               TK50P

MSLG$B_CNT_SVR              01
                               CONTROLLER SOFTWARE VERSION #1.

MSLG$B_CNT_HVR              01
                               CONTROLLER HARDWARE VERSION #1.
```

Controller Dependent Information: Listed below is the controller dependent information for the CDU-720.

```
                                  ;COMMENTS:
                                  ;SCSI COMMAND, 6 BYTES
LONGWORD 1.          00000008     ;COMMAND BYTE 3 TO 0
                     /..../       ;(LEFT TO RIGHT, BYTE 3,2,1,0)
LONGWORD 2.          00000050     ;BYTE 7 TO 6 DONT CARE
                                  ;COMMAND BYTE 5 TO 4
                     /P.../       ;EXTENDED SENSE, 26 BYTES
LONGWORD 3.          00030070     ;SENSE DATA BYTE 3 TO 0
                     /P.../       ;(LEFT TO RIGHT, BYTE 3,2,1,0)
LONGWORD 4.          12000000     ;SENSE DATA BYTE 7 TO 4
                     /..../;
LONGWORD 5.          00000000     ;SENSE DATA BYTE 11 TO 8
                     /..../;
LONGWORD 6.          00000000     ;SENSE DATA BYTE 15 TO 12
                     /..../;
LONGWORD 7.          10000000     ;SENSE DATA BYTE 19 TO 16
                     /..../;
LONGWORD 8.          04000000     ;SENSE DATA BYTE 23 TO 20
                     /..../;
LONGWORD 9.          0000E202     ;SENSE DATA BYTE 26 TO 24
                     /.b../;
LONGWORD 10          00000000     ;(RESERVED)
                     /..../;
```

Refer to the SCSI tape drive manual for a description of the error reported by the tape drive or call CMD for more detailed information.

Cables

If the system does not recognize the CDU-720 or devices connected, check the cable connections. Make sure pin 1 on the cable is aligned with pin 1 on the SCSI device or CDU-720. Make sure pins are *NOT* bent.

LED Indicators

When the Red LED is lit, turn system "OFF" and reboot. If the Red LED is still lit, call CMD technical support at (800) 426-3832 or (714) 454-0800.

CMD Technical Support

Having a CMD board entitles you to responsive technical support. Before you call CMD Technical Support, please gather the information listed below that pertains to your configuration. Make a note of any on-screen messages when a problem occurs and have this manual close by.

CMD	CMD product model number and serial number. Firmware Rev. of CMD board as shown on Eprom on the CDU-720 with a blue CMD logo and copyright label. Listing of jumper settings on the board. Distributor company and contact.
SCSI	SCSI devices model numbers and firmware Rev. as shown in the On-Board Utility. Settings of SCSI ID numbers of all devices.
Computer	Computer model. Operating System version. Complete listing of other controllers in computer backplane. Specify multi-hosting or clustering.
Problem	Describe exact nature of problem. Specify detailed error messages. Specify any recent modification to the system. Is this a new installation? Does the problem occur consistently? Does the problem occur when you do not use the board? Does the problem occur with another system (if available)?

You may contact CMD Technical Support from 8:30 AM to 5:30 PM, Pacific Standard Time, Monday through Friday, excluding major holidays, at:

(714) 454-0800 or
(800) 426-3832 or
(714) 455-1656 FAX

Appendix C

Jumper Settings

This chapter lists the jumper settings and CSR addresses for the CDU-720.

Pin Assignments

Figure C-1 shows the physical pin number assignments of the RS-232 port for accessing the On-Board Utility. Connector J4 pin assignments are listed in Table C-1 shown when you are facing the 10 pin connector from the controller's top edge.

NOTE For CMD's On-Board RS-232 Utility, only pin 3, 8 and grounds are used.

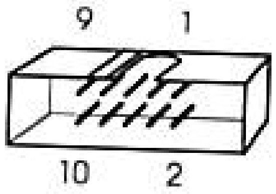


Figure C-1: RS-232 Port connector J4

Table C-1 Pin Assignments for Utility

Pin	RS-232 Port
1	No connect
2	Ground
3	TXD, transmit data for RS-232 application.
4	Ground (use pin 2)
5	No connect
6	No connect
7	No connect
8	RXD, receive data for RS-232 application.
9	Ground (use pin 2)
10	No connect

Table C-2 lists the Host Adapter ID selections; Table C-3 lists all the other jumper selections for the CDU-720.

Table C-2 Host Adapter ID Selections

W6-1	W6-2	W6-3	Initiator ID
IN	IN	IN	Host adapter ID = 7, highest priority (F)
IN	IN	OUT	Host adapter ID = 6
IN	OUT	IN	Host adapter ID = 5
IN	OUT	OUT	Host adapter ID = 4
OUT	IN	IN	Host adapter ID = 3
OUT	IN	OUT	Host adapter ID = 2
OUT	OUT	IN	Host adapter ID = 1
OUT	OUT	OUT	Host adapter ID = 0, lowest priority

Note (F) means factory setting.

Table C-3 CDU-720 Pin Assignments

W1		Reserved (F)
W2	IN	Differential SCSI terminator power enabled (F)
W2	OUT	Differential SCSI terminator power disabled
W3	IN	Single-ended SCSI terminator power enabled (F)
W3	OUT	Single-ended SCSI terminator power disabled
W4	1-2 IN	Reserved (F)
W5	1-2 IN	Auto-Boot disabled for CDU-720/M, /TM (F) Reserved for CDU-720/T (F)
W5	2-3 IN	Auto-Boot enabled for CDU-720/M, /TM
W6-4	IN	Enable tape fast search option
W6-4	OUT	Normal operation (F)
W6-5	IN	Tape Monitor Utility enabled (/T, /TM) Disk SCSIformat ON-LINE enabled (/M, /TM)
W6-5	OUT	Tape Monitor Utility disabled (F) Disk SCSIformat ON-LINE disabled (F)
W6-6	IN	Tape sync. mode disabled
W6-6	OUT	Tape sync. mode enabled (F)
W6-7	IN	Disk sync. mode disabled
W6-7	OUT	Disk sync. mode enabled (F)
W7	1-2 IN	4 us DMA dwell time for CDU-720/M (F)
W7	2-3 IN	2 us DMA dwell time for CDU-720/T, /TM (F)
W9	**W8**	
2-3 IN	2-3 IN	1 Word per DMA burst CDU-720/T, /TM (F)
2-3 IN	1-2 IN	2 Word per DMA burst
1-2 IN	1-2 IN	4 Word per DMA burst CDU-720/M (F)
W10	1-2 IN	Bootstrap address = 773000–CDU-720/M, /TM
W10	2-3 IN	Bootstrap address = 771000–CDU-720/M, /TM (F)
W17, W18, W19		Reserved (F)
W20, W21, W22	1-2 IN	Differential channel enabled; differential SCSI multiple-host protection circuit enabled (F)
W20, W21, W22	2-3 IN	Single-ended channel enabled; single-ended SCSI multiple-host protection circuit enabled

Note (F) means factory setting.

CSR Address Selections

Table C-4 lists the 29 disk CSR addresses supported by the CDU-720/M with the IC P72009A in U102.

Table C-4 CDU-720/M CSR Addresses (IC P72009A in U102)

Address	PDP-11	W11	W12	W13	W14	W15
1	17772150	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
2	17760334	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
3	17760354	1-2 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
4	17760374	1-2 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN
5	17760340	2-3 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
6	17760344	2-3 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
7	17760350	2-3 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
8	17760360	2-3 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN
9	17760364	1-2 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN
10	17760370	1-2 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN
11	17760400	1-2 IN	2-3 IN	1-2 IN	2-3 IN	1-2 IN
12	17760404	1-2 IN	2-3 IN	2-3 IN	2-3 IN	1-2 IN
13	17760410	2-3 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN
14	17760414	2-3 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN
15	17760420	2-3 IN	2-3 IN	1-2 IN	2-3 IN	1-2 IN
16	17760424	2-3 IN	2-3 IN	2-3 IN	2-3 IN	1-2 IN
17	17760430	1-2 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN
18	17760434	1-2 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN
19	17760440	1-2 IN	2-3 IN	1-2 IN	1-2 IN	2-3 IN
20	17760444	1-2 IN	2-3 IN	2-3 IN	1-2 IN	2-3 IN
21	17760450	2-3 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN
22	17760454	2-3 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN
23	17760460	2-3 IN	2-3 IN	1-2 IN	1-2 IN	2-3 IN
24	17760464	2-3 IN	2-3 IN	2-3 IN	1-2 IN	2-3 IN
25	17760470	1-2 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN
26	17760474	1-2 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN
27	17760500	1-2 IN	2-3 IN	1-2 IN	2-3 IN	2-3 IN
28	17760504	1-2 IN	2-3 IN	2-3 IN	2-3 IN	2-3 IN
29	17760510	2-3 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN

Table C-5 lists the 31 tape CSR addresses supported by the CDU-720/T with the IC P720010A in U102.

Table C-5 **CDU-720/T CSR Addresses (IC P72010A in U102)**

Address	PDP-11	W12	W13	W14	W15	W16
1	17774500	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
2	17760404	1-2 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN
3	17760444	1-2 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN
4	17760504	1-2 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN
5	17760544	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
6	17760410	1-2 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN
7	17760450	1-2 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN
8	17760454	1-2 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN
9	17760414	1-2 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
10	17760420	1-2 IN	2-3 IN	1-2 IN	1-2 IN	2-3 IN
11	17760460	1-2 IN	2-3 IN	1-2 IN	2-3 IN	1-2 IN
12	17760510	1-2 IN	2-3 IN	1-2 IN	2-3 IN	2-3 IN
13	17760514	1-2 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN
14	17760520	1-2 IN	2-3 IN	2-3 IN	1-2 IN	2-3 IN
15	17760550	1-2 IN	2-3 IN	2-3 IN	2-3 IN	1-2 IN
16	17760554	1-2 IN	2-3 IN	2-3 IN	2-3 IN	2-3 IN
17	17760560	2-3 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
18	17760604	2-3 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN
19	17760610	2-3 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN
20	17760614	2-3 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN
21	17760620	2-3 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
22	17760644	2-3 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN
23	17760650	2-3 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN
24	17760654	2-3 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN
25	17760660	2-3 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
26	17760704	2-3 IN	2-3 IN	1-2 IN	1-2 IN	2-3 IN
27	17760710	2-3 IN	2-3 IN	1-2 IN	2-3 IN	1-2 IN
28	17760714	2-3 IN	2-3 IN	1-2 IN	2-3 IN	2-3 IN
29	17760744	2-3 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN
30	17760750	2-3 IN	2-3 IN	2-3 IN	1-2 IN	2-3 IN
31	17760754	2-3 IN	2-3 IN	2-3 IN	2-3 IN	1-2 IN

Tables C-6 and C-7 list the eight disk and tape CSR addresses supported by the CDU-720/TM with the IC P720008A in U102.

Table C-6 CDU-720/TM Disk CSR Addresses (IC P72008A in U102)

Address	PDP-11	W11	W12	W13
1	17772150 (F)	1-2 IN	1-2 IN	1-2 IN
2	17760334	1-2 IN	1-2 IN	2-3 IN
3	17760354	1-2 IN	2-3 IN	1-2 IN
4	17760374	1-2 IN	2-3 IN	2-3 IN
5	17760340	2-3 IN	1-2 IN	1-2 IN
6	17760344	2-3 IN	1-2 IN	2-3 IN
7	17760350	2-3 IN	2-3 IN	1-2 IN
8	Disable Disk	2-3 IN	2-3 IN	2-3 IN

Table C-7 CDU-720/TM Tape CSR Addresses (IC P72008A in U102)

Address	PDP-11	W14	W15	W16
1	17774500 (F)	1-2 IN	1-2 IN	1-2 IN
2	17760404	1-2 IN	1-2 IN	2-3 IN
3	17760444	1-2 IN	2-3 IN	1-2 IN
4	17760504	1-2 IN	2-3 IN	2-3 IN
5	17760544	2-3 IN	1-2 IN	1-2 IN
6	17760410	2-3 IN	1-2 IN	2-3 IN
7	17760450	2-3 IN	2-3 IN	1-2 IN
8	Disable Tape	2-3 IN	2-3 IN	2-3 IN

Appendix D

VMS SYSGEN Connect Statement

To properly use the *CONNECT* statement in the SYSGEN Utility of VMS 5.0 and newer versions, the following rules must be followed.

1. Run the SYSGEN Utility, from either terminal mode or through a command file by entering at the system prompt ***MC SYSGEN.***

   It is recommended that you use *SYCONFIG.COM* if an automatic command file is used.

2. Issue the *CONNECT* statement to connect the controller by entering the following line at the *SYSGEN* prompt:

   CONNECT aaaa/ADAPTER=bbb/CSR=%Occcccccc/ VECTOR=%Oddd/DRIVER=eeDRIVER

   Where:

   aaaa—the designation of the controller (no :) such as PTB0.
   bbb—the adapter number which can be found from the *SYSGEN* utility *SHOW/CONFIG* (the NEXUS number) in decimal.
   cccccccc—the CSR of the controller being added on the specified NEXUS preceeded by %O (letter O) in octal.
   ddd—the VECTOR of the controller being added on the specified NEXUS preceeded by %O (letter O) in octal.
   ee —the name of the driver for the controller being connected.

3 Issue the next *CONNECT* statement to connect the drive by entering the following line at the *SYSGEN* prompt:

CONNECT ffff/NOADAPTER/SYSIDHIGH=%Xgggg/ SYSIDLOW= %Xhhhhhhhh/DRIVER=iiDRIVER

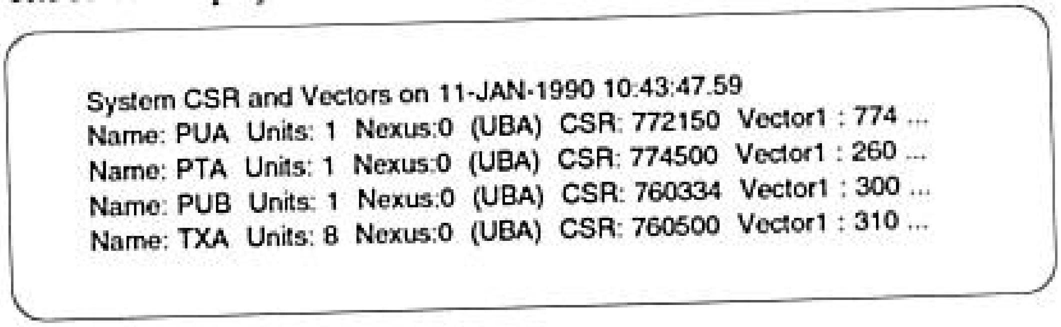
Where:
ffff —the designation of the drive (no :) such as *MUB0*.
gggg—the *SYSIDHIGH* number which is 8000 plus the *NEXUS* number.
hhhhhhhh—the *SYSIDLOW* number which can be obtained after the controller is connected by using the *SYSGEN* utility *SHOW/UNIBUS*. The newly attached controller will be seen at the CSR address previously specified followed by the *SYSIDLOW* number seen in (*hhhhhhhh*).

[EXAMPLE] you may wish to connect a tape drive to a MicroVAX 3300. This tape drive is the third MU: device to be added to the Q-bus. The *AUTOCONNECT* recommended CSR for this device will not be used but the CSR of 760444 will be used instead with a VECTOR of 340 on UB0.

3 View the configuration files by entering the following line at the system prompt:

MC SYSGEN
SHOW/CONFIG

The screen displays the configuration as shown in Figure D-1:



```
System CSR and Vectors on 11-JAN-1990 10:43:47.59
Name: PUA  Units: 1  Nexus:0  (UBA)  CSR: 772150  Vector1 : 774 ...
Name: PTA  Units: 1  Nexus:0  (UBA)  CSR: 774500  Vector1 : 260 ...
Name: PUB  Units: 1  Nexus:0  (UBA)  CSR: 760334  Vector1 : 300 ...
Name: TXA  Units: 8  Nexus:0  (UBA)  CSR: 760500  Vector1 : 310 ...
```

Figure D-1: SYSGEN Config File

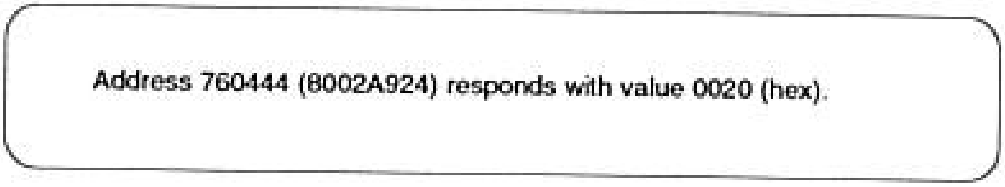
Note the Nexus number *0* for the specified bus.

4 Edit the configuration file to connect the devices by entering the following line at the *SYSGEN* prompt:

CONNECT PTC0/ADAPTER=UB0/CSR=%O760444/ VECTOR=%O340/DRIVER=PUDRIVER

5 Find the address for the Q-bus by entering ***SHOW/UNIBUS***

Figure D-2 shows the address:



```
Address 760444 (8002A924) responds with value 0020 (hex).
```

Figure D-2: Unibus Address

6 Note the *SYSIDLOW* value.

7 Calculate the *SYSIDHIGH* value by adding 8000 to the NEXUS 0 (which is 8000) and enter the following lines at the *SYSGEN* prompt:

CONNECT MUC0/NOADAPTER/SYSIDHIGH=%X8000/ SYSIDLOW=%X8002A924/DRIVER=TUDRIVER

****EXIT* (CONTROL Z to exit)***

Index

A

Asynchronous 3-8

B

Bootstrap 2-7

C

Changing LUN offset 4-5
Command Queuing 2-1, 2-7
Configuration
  Configuration file 3-1, D-1 - D-3
  Hardware 3-3, 3-7 - 3-8, 3-10
  Software 4-19, 4-27 - 4-31
Conventions 1-2
CSR addresses 2-8, 3-1 - 3-5, C-1, C-4 - C-6

D

Data Buffer 2-1
DEC 2-1
Differential channel 2-2
DMA Dwell Time 3-7 - 3-8
DU/MU drivers 2-7
DU/TU drivers 2-1, 2-6, D-3
Dynamic Defect Management 2-7

F

Formatting RCT block 4-15

G

Generic SCSI Adapter 2-6 - 2-7

H

Hardware Shadowing 2-4

I

Initiator 5-1
Installation 3-11, 3-13 - 3-15

J

Jumper settings 3-4 - 3-5, C-1, C-3 - C-6

L

LED Indicators 2-2 - 2-3, 2-7, B-3
LUN 2-2, 4-5, 4-17 - 4-18, 5-1

M

MSCP 2-1, 4-5, 4-20, 5-1 - 5-2, A-3
Multi-hosting 2-4, 2-7, 4-19

N

Non-volatile RAM 2-2

O

On-Board Utility
  Accessing 4-1, 4-5
  Additional Utilities 4-8, 4-10 - 4-11, 4-13 - 4-18, 4-21
  Change configuration 3-11
  Completing 4-15
  Configuring LUN offset 4-5
  Configuring the device 4-8, 4-10 - 4-11, 4-13, 4-16
  Format Command 5-2
  General 2-2, 3-8, 4-1, 4-4 - 4-8, 4-10 - 4-11, 4-13 - 4-15, 4-20 - 4-21, 4-23, 4-26
  Manually replacing bad sectors 4-7

  Qualifying the drive 4-6
Operating temperature 2-7

P
Partitioning 2-4
Power ON/OFF Protection 3-9

S
SCSI Bus 2-1
SCSI bus termination 3-13 - 3-14, 3-16
SCSI cabling 3-13, 3-15, B-3
SCSI commands 5-2
SCSI glossary 5-1
SCSI ID 3-11, 4-17 - 4-18
  Host Adapter 3-11, C-2
  Target devices 3-11
SCSI Library Manager 2-4, 2-6 - 2-7
SCSI status codes 5-3
SCSIformat ON-LINE 2-5, 2-7, 3-10
Sending SCSI commands to the device 4-13
Shadowing 2-5, 2-7
Single-ended channel 2-1 - 2-2
Single-ended mode 4-20
Single-ended signals 5-4 - 5-6
Special Features 2-4 - 2-6
Specifications 2-7
Supported devices 2-7, A-1 - A-3
Supported Operating Systems A-3
Synchronous/Asynchronous 3-8
SYSGEN Utility 3-1 - 3-3, D-1 - D-3

T
Tape Fast Search 3-10
Tape Monitor Utility 2-4 - 2-5, 2-7, 3-10
Target 3-11, 5-2
Technical Support B-4
Terminator power 3-14
Testing SCSI devices 4-14
TMSCP 2-1, 5-1, 5-3, A-3
Troubleshooting B-1 - B-4

U
Ultrix 2-1,4-28 - 4-31, A-3
Unibus 2-1
Unit Numbering 4-16 - 4-18
Unix 2-1, A-3

V
VAX 2-1
Virtual data buffer 2-7
VMS 2-1, 4-21, A-3, D-1
VMS Analyze/Error Utility B-1 - B-3

CDU-720 Quick Reference Guide

I. Determining CSR Address

Before you install the CDU-720 SCSI host adapter under the VMS operating system you must determine the Control and Status Register (CSR) address from which the CDU-720 will be accessed.

For the CDU-720/M, or CDU-720/T, only one CSR address is required. For the CDU-720/TM, two CSR addresses are required. The following procedure shows one method of determining the new CSR address to be used for the CDU-720.

Do not install the new CDU-720 in the system now.

1 Boot the VMS system and log into the system manager account.

2 At the DCL $ prompt, enter *mc sysgen.*

3 At the prompt *sysgen*, enter ***show/config***. The Sysgen Utility will display all the device controllers installed in the system and their corresponding CSR addresses and vectors. Make a note of this list.

4 At the prompt *sysgen*, enter ***config***. This will bring you to the *device* prompt.

5 At the prompt *device*, enter the following for your CDU-720 model [enter all devices on the Unibus, not just the new device being added at present]:

For CDU-720/M enter ***UDA, X***
For CDU-720/T enter ***TU81, Y***
For CDU-720/TM enter ***UDA, X*** and ***TU81, Y***

where:
X is the number of installed *UDA* type controllers plus 1 (for new one being added)
Y is the number of installed *TU81* type controllers plus 1 (for new one being added).

6 At the prompt *device*, enter **[CTRL] + Z**. The Sysgen Utility will display the CSR addresses for all the controllers. Make sure that no other vectors or CSR addresses have changed; if they have, make the appropriate changes to the devices.

The VMS mnemonic for MSCP disk controllers are *PUA, PUB, PUC*, etc. The VMS mnemonic for TMSCP tape controllers are *PTA, PTB, PTC*, etc. For other mnemonics, refer to VMS system manager's guide.

7 At the prompt *sysgen*, enter **[CTRL] + Z** to exit the Sysgen Utility. VMS will automatically program the CDU-720's interrupt vector register to match the vector assigned by the system. The vectors of the controllers might change when the CDU-720 is added to the system; see manufacturer's documentation to configure vectors and device CSR addresses if hardware selectable.

II. CSR Address Selection

Use the CSR address obtained above to configure the CSR jumper settings of the CDU-720 as shown in Tables 1-4. Refer to Appendix C, CDU-720 User's Manual for other CSR jumper settings.

Table 1 CDU-720/M CSR jumper settings–disk

Add.	PDP-11	W11	W12	W13	W14	W15
1	17772150 (F)	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
2	17760334	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
3	17760354	1-2 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
4	17760374	1-2 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN
5	17760340	2-3 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
6	17760344	2-3 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
7	17760350	2-3 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
8	17760360	2-3 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN

Pal IC P72009A must be in U102.

Be sure to wear anti-static wrist straps or equivalent to protect the CDU-720 from electro-static damage.

Table 2 CDU-720/T CSR jumper settings–Tape

Add.	PDP-11	W12	W13	W14	W15	W16
1	17774500 (F)	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
2	17760404	1-2 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN
3	17760444	1-2 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN
4	17760504	1-2 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN
5	17760544	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
6	17760410	1-2 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN
7	17760450	1-2 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN
8	17760454	1-2 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN

Pal IC P72010A must in U102.

Table 3 CDU-720/TM CSR jumper settings–disk

Add.	PDP-11	W11	W12	W13
1	17772150 (F)	1-2 IN	1-2 IN	1-2 IN
2	17760334	1-2 IN	1-2 IN	2-3 IN
3	17760354	1-2 IN	2-3 IN	1-2 IN
4	17760374	1-2 IN	2-3 IN	2-3 IN
5	17760340	2-3 IN	1-2 IN	1-2 IN
6	17760344	2-3 IN	1-2 IN	2-3 IN
7	17760350	2-3 IN	2-3 IN	1-2 IN
8	Disable Disk	2-3 IN	2-3 IN	2-3 IN

Pal IC P72008A must be in U102.

Table 4 CDU-720/TM CSR jumper settings–tape

Add.	PDP-11	W14	W15	W16
1	17774500 (F)	1-2 IN	1-2 IN	1-2 IN
2	17760404	1-2 IN	1-2 IN	2-3 IN
3	17760444	1-2 IN	2-3 IN	1-2 IN
4	17760504	1-2 IN	2-3 IN	2-3 IN
5	17760544	2-3 IN	1-2 IN	1-2 IN
6	17760410	2-3 IN	1-2 IN	2-3 IN
7	17760450	2-3 IN	2-3 IN	1-2 IN
8	Disable Tape	2-3 IN	2-3 IN	2-3 IN

Pal IC P72008A must be in U102.

III. Installation

1 Configure the hardware as explained in "Hardware Configuration" Chapter 3. [Normally, you do not need to change the factory jumper settings for the CDU-720.] Be sure you have set the CSR addresses as described in sections I and II.

2 Set the Device SCSI ID's; see Table 5 for Device ID Selection. If you are changing the factory setting for the CDU-720/TM, refer to Chapter 4, "Unit Numbering."

Table 5 Device ID Selection

Model	Device Support	Target SCSI ID
CQD-240/M	up to 7 disk drives	SCSI ID-0-6
CQD-240/T	up to 7 tape drives	SCSI ID-0-6
CQD-240/TM	up to 7 disk/tape combined 4 disk & 3 tape (F)	SCSI ID-0-3 disks (F) SCSI ID-4-6 tapes (F)

Note that (F) means factory setting

3 Install the CDU-720 into any priority on the standard PDP-11 Unibus SPC backplane. The CDU-720 is a DMA device and requires the Non-processor Grant (NPG) jumper on the SPC card slot in which the controller is being installed be removed. Place the CDU-720 in front of other devices on the Unibus except when there is an Ethernet controller. The CDU-720 should be inserted into C, D, E, F sockets of a Unibus slot.

4 The Non-Processor Grant Signal (NPG) signal jumper is located at pins CA1 to CB1 on the Unibus backplane. Figure 1 is a DD11-DK nine-slot backplane seen from the rear. To locate the NPG jumper follow these instructions:

- **a** From the rear of the backplane locate the card slot in which the board is to be installed. Each card slot is four pins wide.
- **b** Locate the C socket and then locate the pins CA1 and CB1. Remove the jumper wire between the two pins as shown in Figure 1.

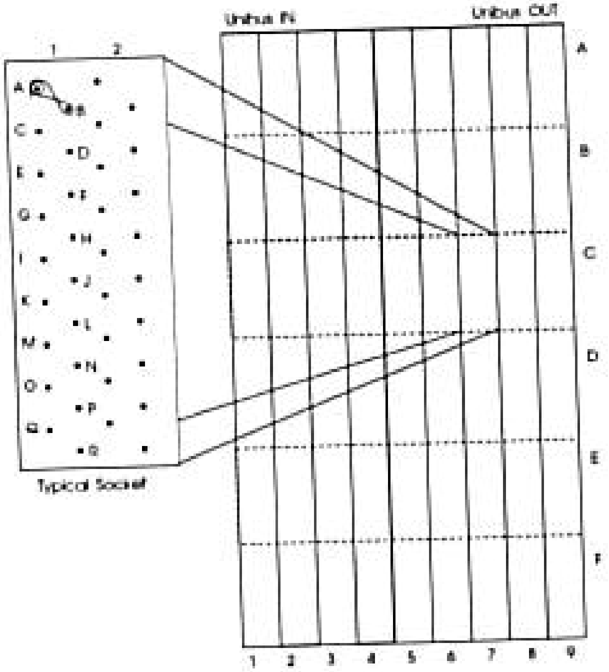


Figure 1: Unibus Wire Wrap Side of Backplane

5 Cable SCSI devices (see "SCSI Bus Cabling," Chapter 3) to J1 for single-ended of the CDU-720 or J2 differential of the CDU-722, see Figures 2 and 3.

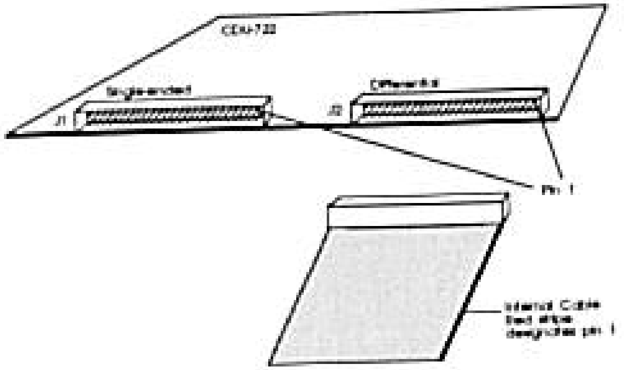


Figure 2: CDU-722 J1 and J2 SCSI ports

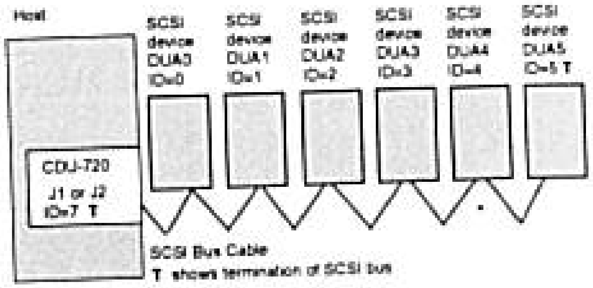


Figure 3: SCSI ID and Cabling

6 Terminate the SCSI bus at each physical end. If the CDU-720 is at one physical end of the bus, place terminators as shown in Table 6.

Table 6 Terminator Power Option

RN1, RN2, RN3, RN4, RN5, RN6, RN7, RN8	IN	Differential Mode Termination
RN1, RN2, RN3, RN4, RN5, RN6, RN7, RN8	OUT	NO Differential Termination
RN9, RN10, RN14	IN	Single-ended Mode Termination
RN9, RN10, RN14	OUT	NO Single-ended Termination

Note that (F) means factory setting

If TERMPWR is needed for the bus, place jumper shunt on W2 for differential or W3 for single-ended as shown in Table 7.

Table 7 Terminator Power Option

W2	IN	Differential SCSI terminator power enabled (F)
W2	OUT	Differential SCSI terminator power disabled
W3	IN	Single-ended SCSI terminator power enabled (F)
W3	OUT	Single-ended SCSI terminator power disabled

Note that (F) means factory setting

7 Power up the system and execute On-Board Utility to scan for the SCSI devices and assure that all devices are seen and functioning properly (see Chapter 4 for On-Board Utility).

8 Boot the system and test with the operating system.

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